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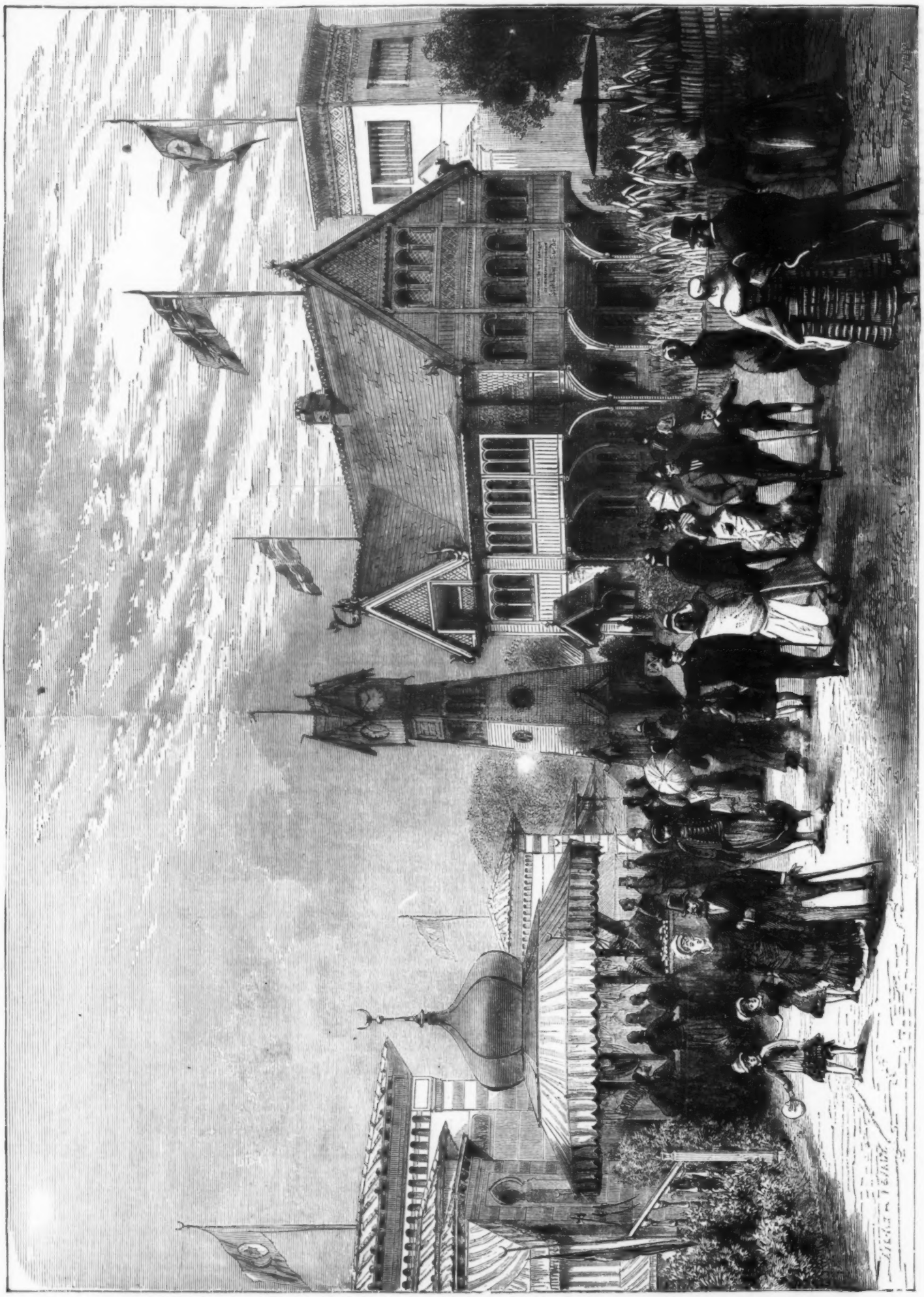
STATUE OF "THE AFRICAN" AT THE PARIS EXHIBITION.

THE celebrated sculptor, Manuel Caron, is said to be an active man among the most active. His studio is more like a gallery, where incessantly there are coming in and going out the most admirable works of art. Our engraving represents one of his most famous sculptures, which last year gained the highest praises from the art critics of Florence, and was this year sent to Paris, as one of the finest examples of Italian culture. The design is that of a female seated upon the hard ground, looking earnestly in the distance, conveying, with inimitable effect, the savage fierceness of the inhabitants of the most remote regions of Africa. So perfectly studied are the type and the character that the whiteness of the marble does not hinder the mind from seeing the figure in the proper color of her race.—*La Academia.*

THE SWEDISH AND NORWEGIAN PAVILIONS AT THE PARIS EXHIBITION.

THE three Norwegian and Swiss cottages erected to the west of the slopes of the Trocadero are three good specimens of the structures of those countries. Considerable inclination, it will be observed, has been given to the roofs; this is for the purpose of preventing too great an accumulation of snow upon them. The sides of the buildings are constructed of thick planks, forming both the inner and outer walls. The front door opens under a porch, from which a promenade may be taken around the entire structure, by means of a veranda. The latter is sheltered by a roof, which is supported either by brackets or light columns. Our illustration gives a good idea of the exterior decoration of these cottages, which make very comfortable dwellings for northern climates. One of the small cottages contains manufactured woods; the other is fitted up as a specimen of a school room, with desk, benches, instruction pictures, materials for teaching the metric system, natural history, etc. The largest cottage is exhibited by a society of joiners of Stockholm, and contains, among other things worthy of remark, doors and paneled ceiling of fir wood; this wood, from a deco.ative point of view, being here used with the happiest effect. In the interior of this same cottage is an exhibition, which, although modest, is worthy of the visit of

THE PARIS EXHIBITION—CARON'S STATUE, "THE AFRICAN."



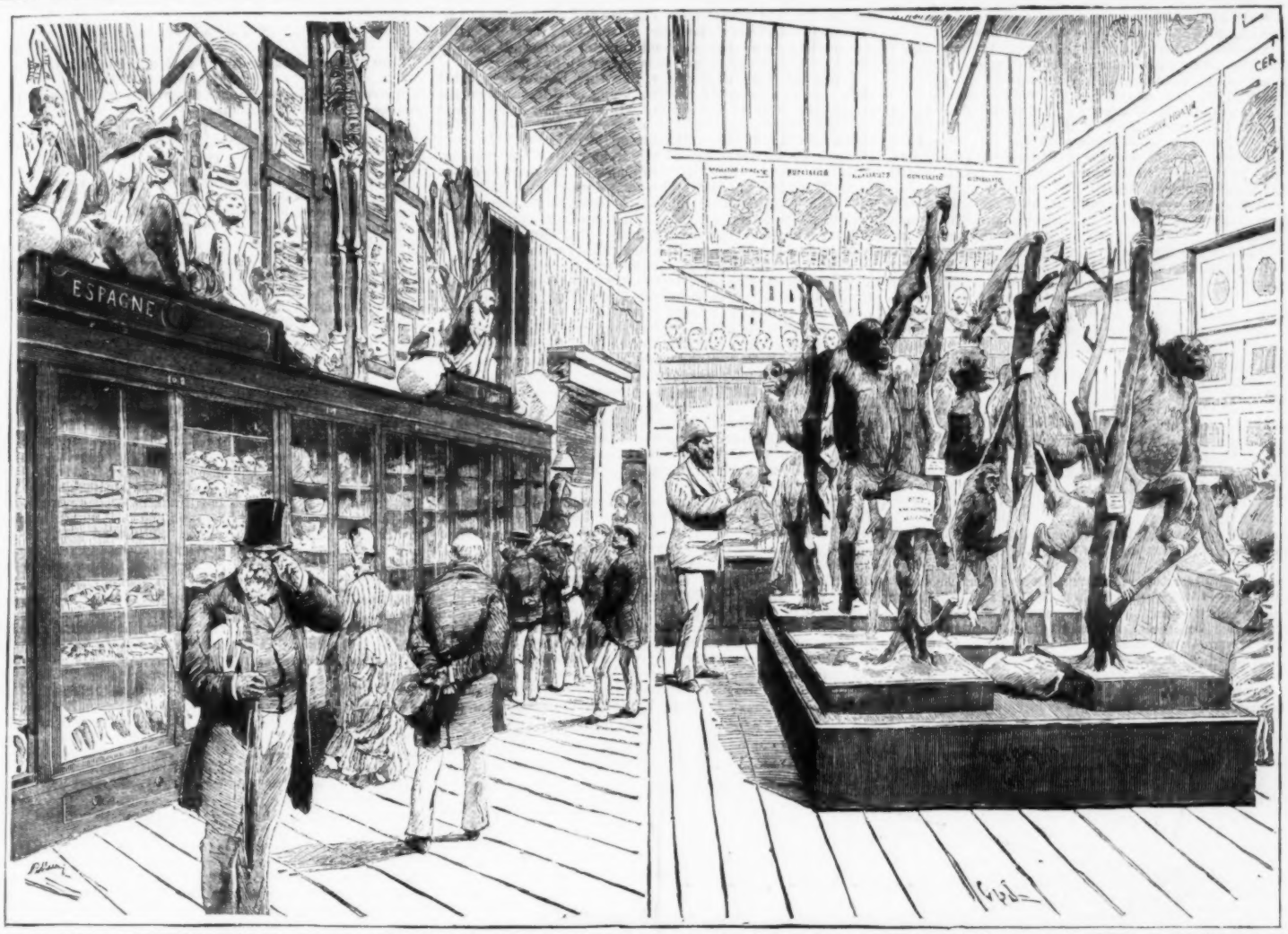
THE PARIS EXHIBITION—PAVILION OF TUNIS AT THE LEFT; PAVILIONS OF SWEDEN AND NORWAY, CENTER AND RIGHT.

all manufacturers and workmen. This society, devoted to manual labor, is engaged in the reproduction of the older designs in furniture, tissues, and various other objects of ancient Scandinavian times. Among the numerous articles exhibited (laces, carpets, and joinery) there are some works of true originality, and, occasionally, of a purity of taste quite out of the common.

In the center of this Swedo-Norwegian quarter is erected a turret of fir wood, a triangular pyramid, the walls of which are covered with fir shingles, laid on in the same manner as slates are in France. At the top of the pyramid is a clock with four dials, inclosed in a box in the form of a cottage. Clocks and clock towers like this are met with in a number of Scandinavian localities. They perform the same mission there as the belfry or other public clocks do with us.

M. Spring, of the Royal Academy of Belgium, has made some experiments on the fine powders of some solid bodies, such as the nitrates of sodium and potassium, sawdust, chalk, etc., with the object of seeing what result would follow if they were subjected to enormous pressure. With an actual pressure of 20,000 atmospheres, he obtained perfectly homogeneous blocks of greater strength and density than hitherto accomplished by any other process. Some of the blocks were semi-transparent, and did not reveal the slightest indication of the particles which composed them. The investigator is continuing his experiments, and some facts of the greatest scientific and industrial interest would appear to be promised by what he has already discovered

The indigo crop in Nicaragua has been destroyed by locusts.



THE PARIS EXHIBITION—THE SPANISH AND FRENCH SECTIONS OF ANTHROPOLOGY AND ETHNOLOGY.

FRENCH EXPRESS LOCOMOTIVE.

OUR engraving shows one of the locomotives of the Eastern Railway of France, as shown at the Exhibition. M. L. Regray, Epernay, Engineer. The cylinders are 17¾ inches diameter, 25 inches stroke; driving wheels 7 ft. 7 in. diameter; total weight of engine 37½ tons.

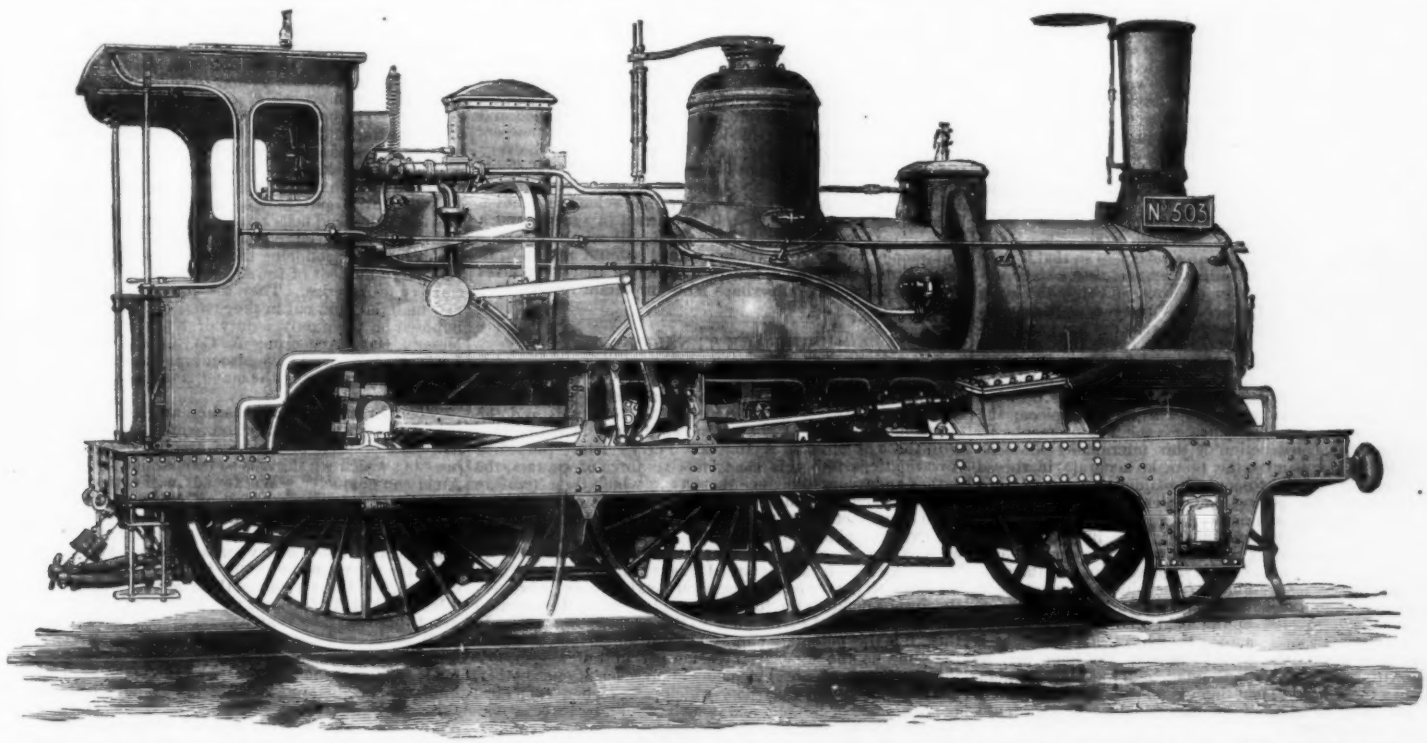
A NEW MICROMETER.*

IT is not every microscopist who can afford a thoroughly efficient micrometer, and it is not always that the possessor of one can find time to use it. What is wanted is a micrometer that shall (1), cost but little; (2), measure accurately with any power; (3), read in decimals of an inch or millimeter, without any calculation; (4), apply equally well with all kinds of illumination; (5), and take no more time to put on than the mere changing of an eye piece. To invent such a micrometer is a problem which I have had before me ever since the summer of 1872, and I now submit to you an instrument which bids fair to solve it.

Noticing one day some scratches on the lamp glass, focused by the achromatic condenser, it struck me that I might use the image of a scale on glass formed in the same way as a micrometer. I saw that I could easily adjust the size of this image to coincide with the divisions on the stage micrometer, by altering the distance between scale and condenser. But this was a troublesome operation, until I fixed the scale in a tube sliding below the lens, and then the divisions had to be so much smaller, that with my appliances I could not get them accurate; and besides it was of no use with large objects or front light, so I gave it up. However, I showed the principle in a rough way at a meeting of the Quekett Microscopical Club, on October 25th, 1872, and was somewhat surprised, a few months later, to find, from the paper on the "Aerial Stage Micrometer," published in the *Monthly Microscopical Journal* of January, 1873, that Dr. Royston-Pigott had been working in the same direction. Dr. Pigott's paper so completely detailed my principle, that I determined to abandon it altogether. So I looked into the theory of the various forms of micrometer.

The early microscopists aimed at getting micrometer and object in the same plane, and so laid the object upon the scale itself, in the lower focus of the objective. The next step was to place a real scale, or spider lines, in the image of the focus of the eye lens, that is to say, in the upper focus of the objective. Browning, in his spectroscope, employs the image of a scale in the same place. Then the aerial stage micrometer reversed the operation with an image of the scale in the plane of the object, formed in the light, before it entered the instrument. In the two foci of the objective all possible variations of real scale or optical image had been used. But every lens has its two conjugate foci. One focus of the eye piece coincides with the upper one of the objective, the other remained. It is only a virtual focus, for its sign is negative. It had not been used, that I know of, except indirectly, for micrometry. I wanted a novelty, so I varied all the conditions, and determined to

* The substance of a paper contributed by Mr. G. J. BURCH to the Proceedings of the Quekett Microscopical Club.



THE PARIS EXHIBITION—EXPRESS PASSENGER LOCOMOTIVE, EASTERN RAILWAY OF FRANCE.

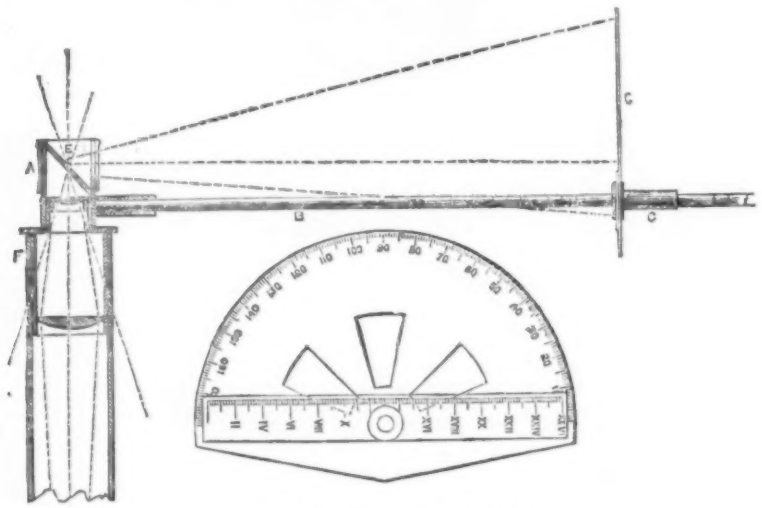
unite an image of the scale with the image of the object, after it had left the eye piece.

At first I proposed to use the glass scale and lens of my aerial stage micrometer, with a diagonal tinted reflector fixed above the eye piece, like a camera lucida set backward. But just then I had occasion to investigate for another purpose the theory of the apparent distance of the magnified object. I found that, as the focus is altered, so the plane of the image varies from the nearest limit of distinct vision to infinite distance. Then why not dispense with the lens altogether, and compare the reflection of the scale itself with the object, adjusting its distance till the divisions on it coincide with those on the stage micrometer?

At first it seemed as if it would be hard to compare the reflection of a real scale with an optical image, but it soon proved otherwise. Just as in the camera lucida you see the image of the object thrown on the paper, and may measure it upon a scale drawn there, so here you see the reflection of the scale in the field of the microscope, and may compare it with the object. This, then, is the principle of the new micrometer. Briefly, it is an inverse application of the camera lucida, coupled with the direct use of a scale, the graduations of which are adjusted to size by varying its distance from the eye piece.

In its simplest form, which I prefer, the instrument consists of a cap, A, slipping over the eye piece, and carrying an arm, B, on which slides a clip, C, to hold the scale, D. The reflection of this scale is thrown into the eye by the diagonal glass, E, and compared with the object seen at the same time through the eye piece, F. It may be objected that this is a heavy side strain for the tube. Practically I have not found it so, but the stem may be brought parallel with the tube by using a second larger mirror of looking-glass, as in the second figure, or the whole thing may be made smaller by having a lens to form the image of the scale. But then the instrument loses its simplicity, and is not easy to use.

The stem should be about ten inches long, and should be made to unscrew. Then, as to the reflector, I find thin cover glass gives a double image. Sömmering's steel disk, the camera lucida, or Dr. Beale's neutral tint glass answers equally well, but for some purposes I should give the preference to a piece of looking-glass with the amalgam scraped off in the center. If silvered glass is used, a tiny drop of nitric acid from a capillary tube will eat the requisite hole very cleanly. In this case the second image is completely overpowered



NEW MICROMETER.

by the superior brilliancy of the reflection from the silvered surface.

The scale may be copied from any graduated rule—millimeters are a convenient size—the length of the stem giving plenty of latitude in this respect. It may be drawn on ivory or card. A barometer scale, with its vernier, answers admirably—there being so few divisions, the eye is not confused in counting them—and it is very accurate. All but the scale itself should be blackened. For some very brightly lit objects a transparent scale is useful, while for very faint ones, or for front light, a white scale on a black ground, or lines engraved on a polished strip of German silver, and illuminated by oblique light, may be employed. This last is the best for star measurement with the telescope, the delicate silvery lines standing out with peculiar distinctness, and without interfering with faint stars.

Any one who possesses a Beale's neutral tint reflector may adapt the new micrometer to it. To adjust the scale (which should be numbered with the figures reversed) so that it may read decimals of an inch or millimeter, etc., use a stage micrometer, set the instrument in position, and slide the scale along the stem nearer or further from the eye, as it may require, till, on adjusting the focus so that the apparent distance of the two images may coincide, every 10th division on the scale shall cover the 1-100th or 1-1000th of the stage micrometer, according to the power used. Then mark the position of the clip on the stem with a file. This position should be found for each objective with each eye piece; the higher the power, the more delicate is the measurement. To the optician the construction of this micrometer offers no difficulties. There is no screw to make accurate in thread and in bearing, no microscopical scale to engrave. It is made in the way that is most convenient, and afterward adjusted to the required standard.

It is easy to use. The micrometer, with its scale clip set to the mark corresponding to the power employed, has only to be slipped on in place of the eye piece cap, and the measurement made by inspection. If the object does not lie in the right direction, twist the clip on the stem, and the image of the scale will revolve in the field of the microscope, so that it can be set exactly across the object. If the light is too strong to permit the scale to be seen, the lamp may be shaded with one hand, while the stage and focusing are managed with the other. Then there is no calculation required. The stem may be marked to read fractions of an inch, a line, or a millimeter.

As regards accuracy, I do not pretend that it will supersede the spider-line micrometer. But as far as all scale micrometers are concerned, it is not inferior to any For it will fill the field with divisions as fine and as close as can be distinguished at ten inches, and no scale can do more. But it is hard to get an eye piece micrometer that reads exactly thousandths, and even then it is only with one power.

The aerial stage micrometer, like this, has an adjustable scale, but on account of the lens being used to produce the image, any error in the setting will make five or six times the difference that it would in mine—in which the error of measurement is the same fraction of the object that the error of setting is of the length of the stem used. The personal equation, too, is evidently eliminated if the miscroscopist himself adjusts the setting by an accurate stage micrometer. But its principal advantage is found in the number of uses to which it may be put. When the stem is unscrewed, it leaves the camera lucida intact. The clip will carry a goniometer—simply a black index, like a watch hand, with parallel sides, revolved by a button from the back in a graduated semicircle—the diameter being drawn specially broad for distinctness. It is as easy of application to a hand magnifier as it is to a microscope.

I use it with my dissecting lens, and even with my diatom finder, a Coddington of 1-20th of an inch focus. For more than a year I have had one fitted to my small lathe, and have rejected the ordinary gauge in its favor. The metal seems to melt away under the tool by thousandths at a time, down to the required size on the scale. My experience of it is, that it would be invaluable to the optician or watchmaker; it reduces the chance of going too far, and saves a deal of time. Then with the spectroscope it is quite as easy of application and as comfortable to use as Browning's arrangement.

I have already mentioned the scale engraved on silver and illuminated by oblique light as being best for astronomical use. It is specially adapted for star spectra, a slight shading of the dark lantern reducing the brilliancy of the lines to any extent, without impairing their distinctness. Nor is this all. Not only can this micrometer be applied to any and every kind of optical instrument, but it can be used by itself for many things that neither carpenter's rule nor calipers can reach. You have only to fit a rod ten inches long in place of the microscope tube, and set the scale ten inches from the reflector, and you may measure the size of anything in the plane of the end of the rod.

The internal diameter of a soda-water bottle; the contraction of the iris in a strong light; the diameter of a dewdrop; or the sweep of a bee's wing as it hovers over a flower—in fact, any of the thousand and one odd things that are commonly supposed to interest the man of science may be determined by this simple arrangement. And I think it not unlikely that it may prove useful to the surgeon, in conjunction with the laryngoscope, as a guide in preparing for an operation.

During the four or five years that I have had it in use I have found it so handy and useful that I determined to show it to Mr. Curties, and ask his opinion. He at once gave a favorable judgment, kindly offered me every assistance and encouragement, and provided one of the new micrometers for presentation to your society. I am aware that the very simplicity of the instrument is prejudicial to it at first sight. There is no mystery of tubes and lenses about it to give it dignity. It looks makeshift rather than scientific. But a little thought will show that it is correct in theory, and a little experience with it will reconcile all who value time and money to its appearance. And I doubt not that, in abler hands than mine, the new principle that it involves will lead to useful and perhaps more important results.

SURFACE TENSION.

By G. N. FITZGERALD, M.A., F.T.C.D.

TAKING the results of M. Lippmann's researches upon the connection between the surface tension of fluids and the electromotive force of contact between them in connection with those of Messrs. Ayton and Perry's lately published investigations into this electromotive force of contact, the author endeavors to deduce the way in which these two are related to one another. Assuming that the electromotive force of contact is due to some form of chemical affinity of the two dissimilar substances for one another, and that to each pair of chemical elements in presence of one another there corresponds an electrical charge equal to that which we know to pass when a chemical bond is made or broken, the author deduces the following expression for the potential energy per unit of surface due to this cause, $T = n\,q\,E$. In this, T is the potential energy per unit of surface, which is the same as the superficial tension per unit of length, n is the number of chemical elements in presence of one another, q is the quantity of electricity which passes when a chemical bond is made or broken, and which we know to be a constant in nature, and E is the electromotive force of contact. If N be the total number of chemical elements per unit mass of the substance, and Q the quantity of electricity required to decompose that unit mass, the above equation may be written:

$$N\,T = n\,Q\,E$$

Then as $\frac{n}{N}$ is the thickness of that superficial layer which is instrumental in producing these effects, if we call this t, the equation may be written:

$$t = \frac{T}{Q.E}$$

If the superficial tension per unit length of water be substituted for T, and the quantity of electricity necessary to decompose a gramme of water be substituted for Q, while E be taken as a tenth of a volt, this equation gives $t = 7{\cdot}3 \times 10^{-8}$, which approximates closely to the value of this quantity obtained by other methods. The author concludes therefore that the superficial potential energy which manifests itself as surface tension is due to some simple form of chemical action which is also the source of the electromotive force of contact of dissimilar substances.

NOTES ON THE AMERICAN HAT TRADE.

NOTWITHSTANDING an intense heat during the whole of my stay in the United States, I made ample use of my time in visiting the various hatting centers of America, and going over various premises devoted to the production of silk, wool and fur hats. The liberality of American manufacturers, not only in the hat, but in other trades, in this respect contrasts greatly with the disinclination of our manufacturers here to permit strangers to see over their premises. Not the slightest difficulty is experienced in inspecting works on the other side of the Atlantic. We are sure that hat manufacturers and others interested in the trade going over to America would be agreeably surprised at this, as the same freedom is certainly not exercised in this country. The custom has its advantages, but to be maintained it must be reciprocal. Nothing could have exceeded the kindness with which we were treated by the leading hat manufacturers of the United States. It is a matter of simple duty, but at the same time a real pleasure, to express through this means our thanks to Mr. Morris, Sr., of Messrs. Morris & Co., Philadelphia, one of the oldest and most respectable manufacturing firms in America; Messrs. J. B. Stetson & Co., Philadelphia, through Mr. H. H. Roelofs, with whom we had the pleasure of going over the premises: and to the Tweedy Manufacturing Company, through Mr. Edmund Tweedy, Danbury, Conn.; and also to Messrs. Root & Tinker, the able proprietors of the *Clothier and Hatter*, and others. The three finest factories in America, as buildings for durability and appearance, we think, are the factories of the Waring Company, Yonkers, and Messrs. Morris & Co., and Stetson & Co., Philadelphia. They are built of brick, chiefly in a style of architecture neat and striking. Having in each case been specially erected for hat manufacturing, the interior portions are consequently built in the most convenient manner. The whole plan of the factories had evidently been studied with care, and each differed in many respects from the other, so that sameness was not apparent. For a factory making exclusively fur hats, that of Messrs. Stetson is a size which would astonish many of our own manufacturers. They employ altogether about 500 hands, and the machinery is turned by an engine of 200 horse power. One of the largest stocks of hatters' fur which we think we ever saw was there. Two large rooms were full of it, and we were assured that there would not be less than 25,000 lbs.

It will not be generally known that mixed hats are not made in the States. A hat is either all fur or all wool, but it is also true that portions of the skins of fur animals are used which we do not use here. The finest fur obtained is nutria—a fur which is extensively used among the American fur hat manufacturers. This animal is an amphibious one, that is, can live on land or in water, and is a native of South and Eastern Africa, and other places in the tropics. It is about half a yard long, with full body but rather small head. In this head are some fierce looking red teeth, which are not at all inviting. Messrs. Stetson have a live one; and to a facetious remark as to whether it had yet become tamed, we were informed that if we attempted to get inside his roomy wired home with a large circular trough in the center, we should be chased out in a way which would be anything but agreeable. It struck us at the time that those who wear hats, and even those who make them, little know what dangers have been undergone to procure the fur of which the hats may be made. Rabbit and hare trapping is mild work when compared to beaver, nutria, and otter catching. A sight of one of these animals in its semi-wild state was quite enough for us, and, unenviable as may at times be the trade of a hat manufacturer, the work of a trapper is more dangerous and exciting. The best portion of the fur comes from the belly of the nutria, and, in fact, of all amphibious animals the belly portions of skins are the best. Of land animals the back portions of the skins are the best. The price of nutria is about 24s. per lb. A mixing, however, of nutria and white cony or nutria and hare or rabbit fur is frequently made. The tail, sides, and belly portion of skins are used extensively, and a plan is now largely adopted of using the blowings and cheap furs for producing the lower qualities of fur hats. A very large number of fur and rabbit skins are sent from this country to America. They are prepared here, sent over as raw material, and cut in the States. By this means they have imposed on them only a duty of 5 per cent. The firm of Messrs. Gay, Armstrong & Co., 21 and 22 Felix street, Lambeth, S.E., who have also a branch house in New York, are well known among the manufacturers over in the country we have recently left.

"The Britishers beat creation, and we beat the Britishers," is the boast of some of our cousins over the water. The hat manufacturers of America are, however, free from the boasting which we think is so inseparable from the orthodox American character. We found in the trade a creditable amount of intelligence, and an enterprise which is commendable. One boast we did hear from a gentleman engaged in one of the branches of the hat trade, that the hat trade in America was fifty years in advance of the trade here. With the thermometer at 100° in the shade, and little time at disposal, we did not combat the assertion, but contented ourselves with saying *perhaps so*. We are not at all prepared to grant that the trade is fifty years in advance of us here, but shall, in this and other letters, touch upon matters where they are ahead of us, and others *vice versa*. A further remark made by one in the hat trade who professed to hail from the midlands of England, was, after asking how trade was in this country, that "we out here look upon the people in the old country as a lot of old fogies." We could not resist the temptation of replying, "What a pity it is, then, that such a young fogy as you didn't stop at home for the benefit of

your country." Without one single exception that was the only disrespectful word which we heard against our dear old country during the whole of our journey of 8,300 miles, and that was spoken by one who professed to be an Englishman.

Hat manufacturing in America is localized across the Atlantic as it is here. Orange and Orange Valley contain the most, and here there are altogether some forty-eight or fifty factories. Newark, the county town, as we should say, of the State of New Jersey, contains some twenty-eight. This is distant about half an hour's traveling from New York, and has the appearance of a thriving well-to-do city. There is a tramway running from Newark to Orange, which is about three miles from the former place. Denton contains about the same number of hat factories as Orange, but in going along by the horse car one is struck by the difference between the two places. Denton is compact, fairly well-built, and some day we suppose will be well paved, and a sprinkling of gas lamps have just been erected to lighten up what has been in past winters a dismal darkness, fatal to the shin, and cleaned boots of a stranger, if he happened to be there at night. On the road from Newark to Orange a brick house is the exception. There is, too, a hastily-built appearance about the wooden villa residences which I saw in that locality. No hedge, or wall, skirts the road, and dotted among the fields and lanes are houses, with grass and weeds growing about, spoiling their picturesqueness. About the factories of Orange there is a similar appearance; long straggling buildings, erected regardless of space, ground there being cheap and timber to be had almost for the picking up. To have walked to every factory in Orange and Orange Valley would have required a good two days to do it in, not taking into account any time spent in calling at the places. Everywhere, in fact, there was this same evidence of unlimited space and breathing room between factory and factory. Plenty of light, plenty of air, gallons of iced water, and workmen stripped to the skin, barefooted, and with their trowsers rolled up were what we observed. Iced water, not only on every floor of each factory, but almost in every room, there in filters, free for the work people to drink of as they wished. The State of Connecticut is the other leading hatting district. Danbury contains the most, where there are some forty-two factories. The town is some sixty to seventy miles from New York, and the railway passes through Bethel, where there are eighteen factories, and Norwalk, where there are nine. Round about Danbury the fields are thickly wooded, and down the hillsides come tumbling brooks of clear water, coursing by the factories, and there free for use without water rates. We purpose referring more particularly to the hatting workmen, the machinery used, and the work produced, but in this letter we cannot refrain from calling the attention of our readers to a bombshell which has been thrown by the ex-premier respecting American trade.—*London Hatters' Gazette.*

THE TRADE IN FALSE HAIR.

FALSE hair having come to be recognized as a necessity of the modern female existence, it may be of interest to learn how this constantly increasing want is supplied. Live hair, bought "on foot" (to use the technical term of the trade), constitutes but a very small percentage of the stock in market, as there are few women who are willing to part with their locks for money, and those who have superfluous locks to spare grow fewer year after year. When second hand tresses were needed merely to furnish wigs for a few elderly ladies, agents found no difficulty in securing a sufficiency among the peasant maids of Auvergne and Brittany. The present demand, however, greatly exceeds the supply, and it is asserted that Paris alone uses more than all the available crop in France, and that Marseilles (the great center of traffic in hair) deals with Spain, the Orient and the two Sicilies for forty tons a year of dark hair, of which she makes upwards of 65,000 chignons annually. Under the name of "dead hair" are classed the "combings," which thrifty servant girls save up and sell, the clippings of barber shops, faded curls, worn out switches, etc. The scavengers of every city, both at home and abroad, value nothing short of a silver spoon among the refuse so much as a snarl of combings, however dirty, as it will find a ready sale. Such findings are afterwards washed with bran and potash, carded, sifted, classed and sorted, and then made into the cheap front curls, puffs and chignons that abound in market. Much of this enters into the cheaper grades of the 350,000 "pieces" annually made in France, of which enormous trade England is said to be the best customer and America almost as good. Late reports on the commerce of Swatow, China, show that a large export trade in "dead" hair gathered in the stalls of barbers sprang up in 1873, during which year 18,800 pounds were exported to Europe. In 1875, the exports of this refuse arose to 134,000 pounds, with a commercial value of over $25,000. It is an undoubted fact, too, that pauper corpses are often despoiled of their hair to meet this same demand of an increasing commerce. Those, then, who sport other than their own natural locks can never be sure whether these are redolent of the sepulcher, the gutter, or the servant girl's comb.

THE GUTTA-PRODUCING PLANTS OF THE MALAY PENINSULA.

IN an appendix to a report of an expedition to Perak, recently made by Mr. Murton, the superintendent of the Botanical Gardens, Singapore, a good deal of information is given regarding the sources of the different kinds of gutta produced in the Malay Peninsula. Five varieties are enumerated, and their respective values in Perak and Salangor given as follows:

	Price per picul. In Perak.	In Salangor.
1. Gutta-soosoo	50 to 52 dols.	not known.
2. Gutta-taban	45 to 50 "	50 dols.
3. Gutta rambong	32 to 35 "	not known.
4. Gutta-singgarip	17 to 20 "	20 dols.
5. Gutta-putih-sundek	15 to 30 "	15 "

Of the first—gutta-soosoo—Mr. Murton was unable to obtain any samples of the tree producing it, and the only information he could gather concerning it was that the tree is entirely destroyed, except in the interior of Perak; that the gutta is firmer in texture than gutta-taban, and contains a little oil. This must not be confounded with the gutta-soosoo of Borneo, which is a caoutchouc or rubber.

The second, or gutta-taban, is the gutta percha of commerce, and the product of a tree described so far back as 1837, by Sir William Hooker, under the name of *Isonandra gutta*, but now known to botanists as *Dichopsis gutta*, Bth. It appears that, in Perak, there are two sorts, alike in foliage and general appearance, and differing only in color of the flowers, one being white and the other red. They are known to the Malays by the names of *Ngiato putih* and *Ngiato merah*, but the products of both trees are called gutta-taban. *Dichopsis gutta* is most abundant on Gunongs Meeru and Sayong, and Bujong, Malacca. A few large trees still exist on Gunong Babo and the Thaipeng range. Small plants, from one to eight feet, are abundant on the granite formations in Perak, up to 3,500 feet elevation.

To procure the milk, the tree is cut down at five or six feet from the ground, and the top cut off immediately, when it becomes too small for ringing. This, the natives say, causes the tree to yield a much larger quantity. The bark is then ringed with small knives called "golos" at intervals of from five to fifteen inches. The milk continues to flow for about an hour, and is collected in vessels made of palm leaves or cocoanut shells, and then boiled for about an hour, otherwise it becomes brittle and useless. Regarding the quantity of gutta each tree is capable of producing, no trustworthy information seems to have been obtained. One of the principal merchants of Perak informed a member of the expedition that a large tree will yield forty catties of gutta, but Mr. Murton regards this as an exaggeration, for from numerous inquiries among the men in the jungles he was told that from five to fifteen catties is about the average quantity obtained, and never more than twenty catties.

No particular season seems to be recognized in Perak for collecting the gutta, and Mr. Murton was unable to glean any information as to whether or not the trees yield more in one season than in another. He considers, however, that in the wet seasons the gutta contains more water, and consequently would require more boiling to drive it off. It is stated that from Klang 83 piculs 83 catties were exported from January to November, 1877; so that it is probable over 700 trees were destroyed to furnish that quantity. The gutta is generally, if not always, exported in the shape of oblong balls, with a loop at the upper end, through which a piece of rattan is put to facilitate its being carried through the jungles. These balls vary considerably in weight, but from 10 to 20 catties is about the average. They are of a grayish white color, with a slightly reddish tint inside. The color, however, varies according to the quantity of bark and other impurities mixed with it; sometimes it is of a bright umber brown.

For the cultivation of *Dichopsis gutta*, it is recommended that plants not more than a foot high should be procured from the jungles; it is necessary to lift them very carefully, as they have long tap roots which are liable to be broken or injured, in which case the plants, even if they survive, take a long time to recover.

The third kind of gutta, namely, gutta-rambong, is described as being more of the nature of caoutchouc, or India rubber. Mr. Murton did not find the tree producing it, and he was informed by the Malays that it was only to be met with in the interior of Perak, and on the Patani side of the Peninsula. These people describe the tree as having large roots above ground, and large, bright green leaves, with red tips to the branches. The milk is obtained from these large roots, which are tapped ten or twelve times a year, a picul being sometimes taken from a large tree; the usual yield, however, is said to be about half a picul. This rubber is said to require no preparation for market. It has the appearance of long strings irregularly welded together; the best quality has a gum-like appearance, is very firm in texture, and of a reddish brown color; the inferior qualities having a large admixture of bark, etc., and are much drier, without the gum-like consistency of the better qualities. The caoutchouc from Perak has much the same appearance as Assam rubber, and Mr. Murton considers there is but little doubt that it is produced by the same tree, *Ficus elastica*, the description given by the Malays agreeing closely with that of the above named plant, the red points to the branches being probably the conspicuous red stipules which envelop the young leaves. From the fact that young plants have been promised to the Singapore Gardens, it is to be hoped that ere long the origin of gutta-rambong will be definitely settled.

Another caoutchouc or India rubber is gutta-singgarip. This agrees very closely in texture, appearance, and in the mode of operation with the gutta-soosoo of Borneo, and Mr. Murton says that an experienced authority, who had spent some time among the gutta-soosoo collectors in Borneo, assured him that they are one and the same product. The plant producing it is a large woody climber, with stems about six or eight inches in diameter, but often much less. There are two varieties; one with very dark colored outer bark and lighter colored warts, and red inner bark; and the other with outer bark light cork-colored, with longitudinal channels, and the inner bark light yellow. The foliage of both plants are described as being very similar to each other, but the fruits differ in form, one being apple-shaped and the other pear shaped. The fruits of both forms are edible, and are eagerly sought after by the Malays. The plants seem to be species of *Willoughbeia*, belonging to the natural order *Apocynaceæ*. The gutta from the dark-barked variety is considered the best. The long, scandent stems are often cut down to procure the milk, but it is not absolutely necessary to do so, except to render the operation of collecting the gutta easier. The stem is generally ringed at intervals of 10 to 20 inches, and the milk allowed to run into vessels made of palm or other leaves, cocoanut shells, or anything available for the purpose; it continues to flow for some time, but after flowing for ten minutes it gets very watery and thin. One plant will yield from 5 to 10 catties of these coagulated caoutchouc. When raw it has the appearance of sour milk, and to coagulate it the natives add salt or salt water. When freshly coagulated it is quite white, but gradually changes to a darker color. It retains its white color inside, and upon cutting it is found to be porous, the pores or cells containing water and salt, which have become inclosed during coagulation. In texture it is soft, very spongy, and very wet. From January to November, 1877, 57 piculs 45 catties of this rubber were exported from Klang alone.

Gutta-putih, or gutta-sundek, is the produce of a species of *Dichopsis*, the leaves of which differ from those of *D. gutta* in being much shorter, broader, and more ovate in general outline. The gutta is obtained and prepared in the same manner as gutta-taban, and trees are frequently met with on the Sayong and Meeru ranges. Of this variety 484 piculs 56 catties were exported from Klang alone, from January to November, 1877. It is much whiter and more spongy than gutta-taban, and is worth only 15 dols. per picul, as against 50 dols. for gutta-taban. In concluding this interesting report, Mr. Murton says: "When crossing the Meeru range from Kinta to Kwalla Kangsa, I cut off some leafy branches from a tree which had been felled and ringed a few days before. These leaves were beautifully yellow on the lower surface, caused by small peltate scales, and not pilose hairs, as the *Isonandras* (*Dichopsis*), but on making inquiries from men about Sayong, they pronounced them to be foliage of some non-gutta yielding tree, which is certainly wrong, as I saw the dry gutta adhering to the bark where it had been ringed. A kind of gutta, called gutta-jalutong, is often used in Perak for mixing with gutta-taban and putih, thus rendering them very brittle, but I have not seen the gutta, nor the tree producing it. *Isonandra Motleyana* is said to yield a gum which, in Java and Sumatra, is known as gutta-kolian, and is used only for adulterating purposes. Various species of fig (*Ficus*) yield large quantities of milk, which in Perak is known as gutta-burong, as the only use to which it is put is for bird catching."

From the foregoing remarks, it will be seen that there is a great deal yet to be learned about the sources of those valuable plants and trees yielding elastic gums, and it is to be hoped that, with an extended knowledge of the plants themselves, increased supplies may also find their way into commerce.—*Journal of the Society of Arts.*

APPLICATION OF WOLFRAM IN THE MANUFACTURE OF IRON AND COAL.

THE utilization of wolfram is dependent upon its ability to combine easily with iron, and change the properties of the latter considerably, even when a very small percentage only is incorporated therewith. Some owners of iron and steel works, esteeming the value of wolfram in this respect, even at present add the crude wolfram ores to the iron in the furnace, without having previously brought them to a chemically pure state. This ought to be abandoned, as it excludes results of constant value. The percentage of metal in the ore varies necessarily. The ore also contains phosphorus, arsenic, sulphur, etc., injuring the iron obtained qualitatively. Hence the difference in the goods produced and the pecuniary results.

By using chemically pure wolfram, in that combination generally met with in the ores, or wolfram in its metallic state, or using it in the shape of wolfram iron and wolframic acid, results are obtained, always showing the same quality, as the quantity to be added is exactly known. Wolfram is advantageously used:

1. In the improvement of cast iron in manufacturing axles and other parts of machinery, propeller screws, toothed wheels, cylinders, drums, balls, guns, screws, and all tempered goods. To obtain cast iron of great firmness and hardness, an addition of ½ to 1 per cent. of wolfram is required.

2. It may be used for improving puddled steel and puddled iron. By the addition of wolfram puddled steel becomes as homogeneous and hard as cast steel, combining considerable tenacity with great hardness. The grain of the breaking surface becomes clear and fine, and no difference is noticeable either in appearance or while working it. The hardness may be increased by further addition of wolfram to a degree by far exceeding that of cast steel. At the same time puddled wolfram steel is worked and forged very easily, and is well adapted for all articles now manufactured from cast steel. By a very moderate addition of wolfram, great homogeneity, and hence tenacity and strength, is obtained. A percentage of more than 3½ increases the hardness only. For wheel tires an addition of 2½ to 3 per cent. has been found most advantageous. For axles ½ to 1½ per cent. is sufficient; for files, saws, dies for coins, augers, cutting heads, etc., the addition of wolfram may amount to as much as 7½ per cent., according to the degree of hardness desired.

The percentage of wolfram in puddled wolfram iron ought never to exceed 2½ per cent., as a greater percentage makes it too hard for further manipulation. The noxious influence of arsenic, sulphur, or phosphorus, which might be contained in the cast iron, is neutralized by wolfram. While cast iron containing these elements has, so far, not been fit for use in the manufacture of wire, sheet iron, and all articles requiring a strong, tough iron, it becomes well adapted for that purpose by an addition of wolfram, furnishing an iron similar to wrought iron of elongated, thready texture, equal to the best schmiede-eisen as regards elasticity, forging capacity, strength, and firmness.

3. Wolfram may be used for making Bessemer steel containing that metal. From experiments it has been shown that the Bessemer process may be applied to a compound of metallic wolfram and steel, that ordinary gray, impure iron made of cokes may be by the addition of wolfram converted into a good quality of steel, and that by this method Bessemer wolfram steel casts in large dimensions may be furnished of better quality than possible heretofore.

4. Wolfram steel may be made directly, the best mode of introducing the wolfram being in an alloy of steel containing from 25 to 50 per cent. of metallic wolfram.

Wolfram steel possesses remarkable hardness and great tenacity, as shown in the so-called "Mushet's special" steel, brought into the market from Sheffield. Tools of wolfram steel for planing machines, cutting heads for lathes, and similar instruments for working iron and steel, preserve their cutting edges admirably. Wolfram steel is also used in telegraphy for making magnets, as they keep their electricity longer.

DESTRUCTION OF BURLS IN WOOL.

ACCORDING to Joly's process the wool or tissue to be freed from vegetable fiber is saturated with a solution of muriate of alumina (chloride of aluminum) at 6° to 7° Baumé. It is then whizzed in a centrifugal, the liquor that flows off being caught and used again. The wool or woolen cloth is next dried and passed into the carbonizing chamber, where it remains for about three-quarters of an hour at the temperature of 212° to 257° Fahrenheit. No formal treatment for neutralizing acids is needed, as when the burls are destroyed by the old process with sulphuric or hydrochloric acid. Washing in soft water—preferably with the addition of Fuller's earth—is sufficient to remove all traces of the muriate of alumina, which is very easily soluble. The great heat of the carbonizing chamber is looked upon by many manufacturers as an obstacle likely to deprive the wool of its softness and elasticity. In the acid process the heat applied does not exceed 156° to 167° Fah. The injurious effect of the higher temperature upon the fiber does not seem to be permanent. The action of muriate of alumina upon textile fibers is by no means fully explained. As a powerful dehydrating (water removing) agent it is calculated, just like the sulphuric and muriatic acids, to destroy any vegetable fibers adhering to the wool, while leaving the wool itself untouched, always supposing that it can be brought to bear upon wool in its anhydrous condition. But chloride of aluminum, on the concentration of its aqueous solution, is resolved into alumina and muriatic acid, so that this decomposition ought to take place during the carbonizing process. But then we should expect that the alumina would be fixed upon the fiber, while the escaping vapors of muriatic acid would have the same destructive effect upon the colors as have the acids in the old process. The strong affinity of the alumina for the fiber ought, we should think, to promote this decomposition.—*Deutsch. Wollengewerbe und Zeitschr. f. Chemisch. Grossgewerbe.*

SOME CAUSES OF THE SCALING OFF OF THE COATING ON NICKEL-PLATED GOODS, AND THEIR REMEDIES.

SCALING off may be produced by different causes. The surface of the article may have been imperfectly cleaned and freed of grease previous to immersion; the anodes of the salts of nickel employed may have been impure, or the electric current may have lacked regularity and intensity; it may also have been omitted to plunge the plated articles into boiling water for a few minutes immediately on removing them from the bath.

To free metals completely of grease a boiling solution of pure potash answers best. Care must be taken not to touch the cleaned articles with the hand before placing them in the bath.

The best method of cleaning copper and its alloys consists in plunging the articles into a solution made by dissolving in 4½ liters of rain water 250 grms. of chemically pure muriatic acid of 66° and 250 grms. of pure muriate of ammonia; for iron or steel a solution of 250 grms. of cyanide of potassium in 4½ liters of water will answer. The editor of the *Metall Arbeiter*, however, recommends a solution of potash in diluted muriatic acid. All these solutions do not act so energetically that the operator cannot easily control the process without fear of corrosion. The salts of nickel employed must be strictly pure. As a general thing, sufficient attention is not paid to this point, although it is one of the utmost importance; when the nickel contains sulphur or arsenic, it cannot possibly give good results. But even when all these points are carefully considered, it is indispensable that, immediately after taking the articles from the bath, they should be placed for a few minutes in boiling water.

The chief cause of unsuccessful attempts in plating is the weakness or the irregularity of the current. Generally Bunsen elements are recommended, but for a bath of 50 liters quite a number are required, and then their management is difficult. The best way is to employ a dynamo-electric machine, the intensity of which may be regulated at will, while the machine is always ready for work.—L. METZGER, *in the Metall Arbeiter.*

FADING OF CARBON PRINTS.

WITH as much grief as surprise we have received from Mr. J. G. Tunny of Edinburgh, the details of a discovery made by him in connection with the recently well-worn subject of the "fading of carbon prints."

It appears that Mr. Tunny had received specimens of the "chromotype" method of printing and finishing pictures which had been sent to him with a view of enlisting his sympathies in this class of photograph. These examples possessed a rich bloom, but for some reason which he does not give, Mr. Tunny conceived the idea that they were not entirely above suspicion; hence he exposed one-half of them to light with the unpleasant result that he found a sensible deterioration caused in the portion exposed to light.

Here is the important point in this discovery: it was found that the alizarine or other pigment by which the tone of the carbon was modified had in this case nothing to do with the fading in question, for the deterioration was most marked in the whites. Of one of the prints, which had been exposed to light for several days, Mr. Tunny says: "At this moment it presents the appearance of a silver print on albumenized paper when it gets into the yellow or 'old cheese' condition." As we have in our possession the specimen thus alluded to, we are in a position to confirm Mr. Tunny's estimate. "After many experiments," he continues, "in the hope of discovering the cause of the dreadful deterioration that had taken place, but without having been successful, the idea struck me that possibly the evil might reside in the first preparation of the transfer paper."

Acting upon the impulse of this happy inspiration, Mr. Tunny immediately exposed to light slips cut from sheets of transfer paper. These slips he has sent to us, and they unmistakably reveal the fact of Mr. Tunny's having made the important discovery that in the transfer paper is found the origin of a large amount of the fading which has hitherto been attributed to the pigments mixed with the carbon. In the specimen picture received the yellowing of the print has so reduced the lights that the original brilliancy has been completely lost. The fine bloom and richness imparted by the alizarine has been quite overpowered by the discoloration of the paper support under the action of light. Mr. Tunny remarks: "At this moment carbon printing is at a standstill; I have not a roll of double transfer paper that I would risk sending out a picture upon. The commercial loss will be nothing to the heart-burnings expressed by dissatisfied customers that we shall have to endure."

This, truly, is one of the most important discoveries in connection with carbon printing that has been made for a long time past. We wish very much that there had been no foundation for the alarm expressed, but of the facts we cannot entertain a single doubt; for we have now before us three slips of transfer paper which have been partially exposed to light, with the result that the protected portions of each slip retain their pristine purity, while the exposed parts are of a nondescript yellow color. These slips are respectively "special double transfer," "single transfer," and "opal transfer." They each bear date of having been exposed to light (part of them being protected) from June 15, 1878, to the 28th of the same month. The kind of paper last named has sustained the least degree of coloration.

Let us now look this matter squarely in the face. The complaint respecting the fading of carbon prints is very far from being new to us; but on theoretical grounds we have all along insisted upon the impossibility of the whites becoming deteriorated, and on the assumption of the purity of the paper upon which the print is transferred our theory is absolutely unassailable. In the employment, however, of paper so impregnated with any kind of material as to be amenable to the action of light the conditions become altogether changed. That the whites, under proper conditions, do remain pure we know both on theoretical grounds and on those based on experience. Even in the letter we received from Mr. Tunny there was inclosed a carbon portrait of his deceased son, taken previous to the meeting of the Photographic Society of Scotland held in May, 1864; for, as we very well remember, the picture in question, together with several others in carbon, was exhibited at the meeting of that society in the month mentioned. This portrait, although over fourteen years old, possesses whites of absolute purity. It was printed by a modification of Fargier's process, and was transferred from the glass plate upon which it was exposed to a sheet of albumenized paper on which it was developed.

It has always been imagined that a film of gelatine rendered insoluble with chrome alum, and which is popularly believed to represent all the material on transfer paper, was unacted upon by light, however protracted might be the exposure; but in subjecting this matter to investigation we are met at the outset by this difficulty—that we are not by any means certain in what manner or with what preparations the transfer paper in question was manufactured. On referring to Liesegang's *Carbon Manual*, recently published, we find that the method of preparing double transfer paper there described consists in coating paper with a forty-eight grain solution of gelatine, containing five to ten grains of glycerine and forty-eight minims of a saturated aqueous solution of chrome alum. It is also stated that, in order to impart a finer surface to this paper, twenty grains of sulphate of baryta, together with small quantities of indigo, ultramarine, carmine lake, or other colors, may be mixed with the gelatine. If such mixtures as these are to be applied to the paper it is not difficult to discover the point at which fading is induced.

Be the precise cause what it may, we are very certain it is only sufficient that the existence of the evil be pointed out to insure the speedy application of an effectual remedy; and it is not saying too much that, after having attention thus publicly directed toward a serious shortcoming in transfer-paper, no manufacturer of this article will do his duty properly to the public unless the issue of such paper be henceforth restricted to that which has either been tested or prepared in such a way as to render its stability under exposure to light a matter above suspicion. That such will be the case we are quite confident. Meanwhile, the thanks of photographers are due to Mr. Tunny for having made the discovery of a hitherto "unsuspected cause of fading of carbon prints."—*British Journal of Photography.*

A NEW COLORING MATTER.

THE well-known color manufacturers, Meister, Lucius, and Bruning, of Höchst-on-the-Main, prepares a series of colors for the production of ponceaus, both of the yellower and redder tones, upon wool, as also clarets. These dyes are obtained by the action of the sulpho-naphthylates upon the diazo-compounds of benzol, of its homologues, and of naphthalin. They are offered for sale as ponceau by (the yellowest shade) R, RR, and RRR (the reddest), and as Bordeaux (claret) B. They may be used merely with the addition of sulphuric acid, though the shades produced are brighter with the addition of solution of tin.

The following are directions for dyeing a ponceau on wool:—

Boil the wool in a block tin or wooden beck with 2½ per cent. of its weight of tartar; add the color previously dissolved, give a few turns, and gradually add 5 per cent. of the tin solution as given below. Lift, cool, and wash.

The tin solution prescribed is made by mixing three parts muriatic acid, one part nitric acid, and one part water (probably by measure), and dissolving 1 lb. of tin in every 6 lbs. of the mixture.—*Färber Zeitung.*

MANUFACTURE OF RESORCINE, EOSINE, AND THE OTHER DERIVATIVES OF RESORCINE.

By MM. BINDSCHEDLER and BUSCH.

1. *Resorcine.*—Eglé's process has been abandoned, and the following is used in its stead:—Into a cast iron apparatus fitted with an agitator and a cohobator of lead are poured 198 lbs. of fuming sulphuric acid, and 52½ lbs. of chemically pure benzol are introduced by the cohobator in a slender stream, stirring continually. The mass heats gradually, and arrives at the boiling point of benzol. The vapors of benzol not attacked by the sulphuric acid are condensed in the cohobator and fall back into the apparatus. After the lapse of two or three hours all the benzol has disappeared and is transformed into sulphobenzolic acid. The cohobator is detached, and the lid of the apparatus is connected with a distillation worm, and heat is gradually applied till the temperature rises to 527° Fahr. At this heat the sulphobenzolic acid is converted into disulphobenzolic acid, and there distills over, along with water, a little benzol which has escaped the reaction. It is left at this temperature for twenty minutes, and the mass is then generally let cool and poured into a large quantity of water—about 457 gallons. It is then heated to a boil, and exactly neutralized with milk of lime.

The matter is then driven through a filter press, which retains the sulphate of lime, while the colorless liquid contains all the disulphobenzolic acid as a salt of lime. It is now transformed into a soda salt by adding the equivalent quantity of carbonate of soda. It is passed again through a filter press which retains the carbonate of lime, and the liquid is evaporated. Of this product, when perfectly dry, 132 lbs. are placed in a cast iron boiler, where 330 lbs. of caustic soda at 76 per cent. have been already dissolved in a small quantity of water. The whole is heated for eight or nine hours to 518° Fah., stirring the mass continually, which gradually becomes almost solid. It is allowed to cool, and is then dissolved in 110 gallons of boiling water; to this solution is added a certain quantity of muriatic acid, keeping the whole at a boil, so that the sulphurous acid formed may escape.

The liquid, thus rendered feebly acid, deposits a little tarry matter. When completely cold it is carefully filtered and introduced into the extraction apparatus.

These are large copper cylinders holding about 55 gallons, and fitted with agitators. These are entirely filled with the liquid to be extracted, and a current of ethylic ether is passed very slowly through, agitating gently all the while. During its passage it becomes saturated with resorcine, and is then received in stills, where it is distilled in proportion as it enters. This distilled ether takes continually the same circuit through the liquid till entirely spent.

In the stills there remains resorcine as a colorless liquid, which, on cooling, forms a crystalline mass.

To expel the last traces of ether and of water, which are retained with great tenacity, it is heated in enameled vessels to 419° Fah. When cold it is very hard and brittle, and forms the commercial product.

It contains from 92 to 94 per cent. of pure resorcine, besides a little phenol, and leaves on distillation 5 per cent. of a tarry matter. In this process the water distills first, and then the phenol. What passes over afterward is resorcine almost absolutely pure. The yield is almost equal to what theory demands. The present price of fuming sulphuric acid is so low that distilled resorcine can be sold for 16s. 8d. per 2 lbs. 3 ozs., while as lately as in 1875 it was sold in a less pure state at 24s.

Another method of purifying crude resorcine consists in the crystallization of a very concentrated aqueous solution, but the loss by this process is greater than by distillation, and the result less pure.

2. *Fluoresceine.*—Anhydrous phthalic acid, chemically pure, and in very fine crystalline needles, obtained by slow sublimation, is now to be bought at 15s. per 2 lbs. 3 ozs. This manufacture has also experienced improvements which are as yet, however, far from giving the theoretical yield, and we believe that it will soon be had at 12s. 6d. per 2 lbs. 3 ozs. At this price phthalic acid will be employed in larger quantities than at present, as such a reduction of price will permit the manufacture of certain of its derivatives, which are dyes of great beauty. Fluoresceine is obtained by melting 100 parts of resorcine with 75 parts of anhydrous phthalic acid. It is heated for an hour to 410° Fah., allowed to cool, and finally ground. No purification is requisite.

3. *Yellowish Eosine (soluble in water).—First Process.*—Stir up 2 lbs. 3 ozs. of finely-powdered fluoresceine in 17½ fluid ozs. of alcohol, and add slowly and in a very slender stream 2 lbs. 6½ ozs. of bromine, stirring the liquid very carefully. All the fluoresceine already partially bromated is now present in solution. Continue to add slowly a further portion of 2 lbs. 6½ ozs. of bromine; each drop as it falls forms a crystalline precipitate of tetrabromfluoresceine. The whole is left to settle for some hours, and decanted. The liquid thus poured off contains the hydrobromic acid and the by-products; that is to say, an eosine of an inferior quality, yielding duskier shades. The hydrobromic acid serves for the regeneration of bromine. The crystalline deposit is washed at first with a little alcohol to remove the mother-liquors, and then with water till the washings are completely neutral. It is then stirred up in hot water, and carefully saturated with caustic soda, care being taken not to render the liquid alkaline. On evaporating this solution tetrabromfluoresceine sodium (soluble eosine) is obtained in a crystalline powder.

Second Process.—Five parts of fluoresceine are dissolved in 200 parts by weight of boiling water, adding the necessary quantity of caustic soda to effect the complete solution of the fluoresceine. On the other hand, 11 parts of soda are dissolved in the necessary quantity of dilute caustic soda, to effect the complete decoloration of the liquid. The two solutions are then mixed, and we add slowly, in a slender stream, muriatic acid in quantity sufficient to render the liquid acid, and to set all the bromine at liberty. The first part of the muriatic acid added precipitates the fluoresceine in a state of very fine division; the following portions liberate the bromine, which combines immediately with the fluoresceine, and transforms it into tetrabromfluoresceine. This product is filtered, carefully washed, and dissolved in alkaline water and evaporated, as in the first process. The product thus obtained is not quite as beautiful, and does not give as bloomy shades, as that produced by the first process; but the yield of color is much greater, and the product is pure enough for many purposes in dyeing. The selling price of yellow eosine soluble in water varies at present from 16d. per oz. to 14½d., according to the brilliance of its tone.

4. *Blue Eosine (soluble in water).—(Tetraiodfluorescein Sodium).*—This compound gives reds verging much more to a blue than does the preceding. It is occasionally sold under the name of *erythrosine*, and, on account of the high price of iodine, it is now worth 1s. 8d. per ounce. It is prepared as follows:—Fluoresceine is dissolved in alkaline water, and the necessary quantity of iodine is added, previously dissolved in dilute caustic soda. By the addition of an acid the fluoresceine and the iodine are set at liberty, and combine instantly, forming crystalline tetraiodfluoresceine. The mother liquors contain the portion of iodine which has not entered into combination, in the form of iodide of sodium, from which it may be recovered by means of sulphuric acid and bichrome. The precipitate of tetraiodfluoresceine is dissolved in weak caustic soda and evaporated, when it forms the commercial article.

(Our readers will understand that "yellow" eosine is a compound of bromine, and "blue" eosine is a compound of iodine.)

5. *Safrosine (soluble in water).*—This product is a compound of soda with the bromated and nitrated derivative of fluoresceine, and is prepared as follows:—Nine parts of tetrabromfluoresceine (yellow eosine) are dissolved in alkaline water, eight parts of nitrate of soda are added; the mixture is raised to a boil, and fifteen parts of double oil of vitriol (not fuming) are added. The precipitate, at first of an intense red, is slowly decolorized, and at last appears in flocks of the color of sulphuret of manganese. We filter, wash, and redissolve in weak caustic soda and evaporate. By slowly cooling a saturated boiling alcoholic solution, we can easily obtain it in small crystals, having the appearance of magenta. Safrosine (which must not be confounded with saffranine) is often sold under the names of nopaline, coccine, lutecienne, etc. It dyes wool of a beautiful red, more intense but more on the blue side than that yielded by eosine. If mixed with naphthaline orange it may in certain cases serve as a substitute for cochineal. It is worth at present 8¾d. per oz. pure, but not crystallized. On silk it gives shades much less brilliant than does eosine.

Eosine (soluble in Alcohol). Alcohol Primrose, etc.—The eosines soluble only in alcohol yield both in dyeing and printing shades much more blooming and solid than the eosines soluble in water. Both the methylated and the ethylated derivatives of tetrabromfluoresceine are manufactured, the first having a tone rather more yellow than the latter. Their preparation is effected in the same manner, methylic or ethylic alcohol being employed as the case may be. Five parts by weight of tetrabromfluoresceine are mixed with ten parts of pure methylic alcohol and nine of oil of vitriol. The mixture is heated for four hours in the water bath with a cohobator, and is then poured into a large quantity of cold water. Filter, wash, and convert the precipitate into a potash salt, by boiling it with a solution of carbonate of potash. The filtrate contains a little tetrabromfluoresceine, which has escaped methylization. The precipitate is a compound of the methyl derivative of tetrabromfluoresceine with potash. It dissolves in a mixture of equal parts of alcohol and water. The solution displays a splendid fluorescence.—*Moniteur Scientifique.*

A NEW MUCILAGE.

IT is stated in the *Journal de Pharmacie* that if 20 grains of sulphate of aluminum, dissolved in ⅔ of an ounce of water, be added to 8½ fluid ounces of a mucilage of gum arabic, a strong mucilage will be formed, which will serve to cement wood, porcelain, or glass.

NEW METHOD OF PREPARING ANTHRAQUINONE.—Heinzerling and Gowan purify anthracene by means of sulphide of carbon, and convert it into anthraquinone by heating it with an excess of chloride of lime in a small quantity of water, or of muriatic acid. The same authors treat alizarine with cyanide or sulphocyanide of potassium to improve its tone (?).—*Berichte Deutsch. Chem. Gesell.*

IMPROVEMENTS AND INVENTIONS.

G. & F. LÖWIG propose the following improvements in the manufacture of aluminous salts and caustic alkalies. A concentrated solution of aluminate of potash or soda is heated with a paste of hydrate of lime, which can be replaced by any other of the alkaline earths. A compound of three equivalents lime, with one equivalent alumina, is deposited as a totally insoluble precipitate, while caustic alkali remains in solution and is evaporated down.

The aluminate of lime, thoroughly washed, is divided into two equal portions, one of which is dissolved in muriatic acid, while the other is stirred up with water to a paste, and is gradually added to the muriatic solution, until on filtering mere traces of alumina can be detected. In this manner a hydrated alumina is obtained well adapted for decolorizing purposes, especially for sugar-cane juice, and is also readily soluble in acetic acid. If to the muriatic solution there are added various quantities of aluminate of lime, the compounds of alumina and of the alkaline earths can be obtained in any desired proportion.

In an additional patent the inventors describe the preparation of the aluminate of alkali required in their process.

The Baden Aniline and Soda Works, of Mannheim, patent a process for the preparation of blue coloring matters from dimethylaniline and other tertiary aromatic monamines. The reactions applied in this process are essentially the same, by means of which Lauth has prepared violet coloring matters from paraphenylendiamine. By the introduction of methyl and its homologues, these coloring matters are converted into blue and green colors. The difficult preparation of phenylendiamine prevented the practical application of Lauth's process. The present patent takes dimethylaniline for its raw material. By treating its muriate with nitrate of soda, nitrosodimethylaniline is prepared and reduced to amidodimethylaniline by means of sulphureted hydrogen. The solution of the muriate, saturated with sulphureted hydrogen, is now submitted to oxidation by means of the perchloride of iron. Or amidodimethylaniline may first be oxidized, and the blue coloring matter then produced by means of sulphureted hydrogen. These two operations must follow quickly upon each other. The coloring matter is isolated as follows: The mixture is saturated with common salt, and by means of chloride of zinc the combination of the dye with this body is precipitated and filtered. By treating the precipitate with water, the coloring matter, which is easily soluble, is extracted. The solution is again saturated with salt, and precipitated with chloride of zinc. The precipitate is filtered, pressed, dried, and is then ready for the market. Analogous compounds may be used in place of dimethylaniline.

Soren Sorensen, of Copenhagen, manufactures artificial leather from leather waste. The comminuted shavings, etc., are kneaded with ammonia and with caoutchouc soaked in oil of turpentine, and then pressed. For sole-leather he takes 67 parts of leather shavings, the same weight of ammonia, and 25 of caoutchouc.

O. Thummel melts amber in oil and saponifies the mass, thus obtaining an amber soap.

Dietrich and Schnitzer improves the extraction of tartaric acid by submitting crude tartar, lees of wine, etc., to a heat of 330° Fah., either by open fire or steam.

DISSOCIATION OF THE OXIDES OF THE PLATINUM GROUP.

By H. SAINTE-CLAIRE DEVILLE and H. DEBRAY.

PLATINUM is distinguished from the other metals present in its ores by the fact that it does not combine directly with oxygen, in whatever condition the two bodies may be placed. With rhodium, palladium, and iridium the case is otherwise. If heated in a muffle, at a temperature not too elevated, these metals combine with oxygen, but their oxides are decomposed at a stronger heat. Osmium and ruthenium combine directly with oxygen. The product of this oxidation is volatile, and is formed at the highest temperatures. Osmium most strongly ignited, though less alterable than osmium obtained at a low temperature, is transformed into osmic acid, even at the common temperature. Ruthenium behaves exactly like osmium. The metal, after strong ignition, is oxidized in the muffle at a temperature scarcely above 400°, and is volatilized in abundance: it is difficult to say in what state, for the substance always gives off the odor of ozone, the formation of which always accompanies the decomposition of hyperruthenic acid. Possibly the product deposited in the muffle is the binoxide. This oxide is obtained in crystals, in a tube of porcelain traversed by a current of oxygen, in which matters containing ruthenium are heated. It is thus that M. Frémy has proved its volatility, and discovered the means of extracting it directly, and in the most beautiful forms, from among the products of the roasting of the osmide of iridium. Thus ruthenium, which in the metallic state is one of the most fixed matters known, evaporates rapidly in a muffle. These properties absolutely distinguish osmium and ruthenium from the other platinum metals. These two, by the manner of their behavior in contact with oxygen, evidently approximate to arsenic and antimony, and, like these latter, might be placed among the non-metallic bodies. With rhodium, palladium, and iridium the case is different. Their oxides can be decomposed by heat, and thus the laws of their dissociation and the tension which it takes at different temperatures can be ascertained. For iridium the following numbers have been found:

Temperatures.	Tension of Dissociation.
	mm.
822·8	5·00
1003·3	203·27
1112·0	710·69
1139·0	745·00

[CHEMICAL REVIEW.]

REPORTS ON COLORING MATTERS.

THIS committee knows, and has already distinguished by a reward, the researches of M. Rosenstiehl upon the bases of the aromatic series, especially upon pseudotoluidine, which he has discovered, and which he has taken for the starting point of an inquiry into the rosanilines. The activity of this eminent chemist has not since been relaxed. Independently of very ingenious experiments upon color considered with reference to the sense of sight, we are indebted to him for a series of publications on the coloring matters formerly derived from madder, but now produced artificially. Madder contains not merely alizarine, but also, as has long been known, purpurine. With these bodies are associated two others, the madder-orange of Runge and pseudopurpurine. All these bodies have been the object of the recent researches of M. Rosenstiehl.

Purpurine plays an important part in dyeing. Madder-red and the fine red produced with madder flowers cannot be got up with alizarine alone, but require the addition of purpurine.

This substance differs from alizarine by containing an atom of oxygen more; and if alizarine is dioxyanthraquinone, purpurine represents trioxyanthraquinone. But it is a curious thing, and very frequent in the series in question, there exist several bodies which present the composition of trioxyanthraquinone. Four are known, and M. Rosenstiehl has made a complete study of them.

Pseudopurpurine is connected to purpurine by a very simple reaction which has been discovered by the author. When heated to 356° Fahrenheit it is resolved into purpurine and carbonic acid.

By a quite analogous reaction, the orange-red of madder, above-mentioned, is connected to alizarine, or dioxyanthraquinone. It contains the elements of this body along with those of carbonic acid.

These researches are not only interesting from a theoretical point of view, and throw also a useful light on the practice of the art of dyeing. M. Rosenstiehl has shown, in particular, that alizarine, natural or artificial, does not dye goods mordanted with alumina and iron, except in presence of a certain quantity of carbonate of lime—a curious observation, which explains the accidents and unevenness so often met with.

PREPARATION OF METHYLIC PRODUCTS.

THE chloride of methyl is a product which the manufacturers of coal tar colors will find it advantageous to employ It can serve in a general manner for the fabrication of the colored or colorable products in which methyl plays any part whatsoever; such as methylaniline, methyldiphenylamine, methyltoluidine (which yields a reddish violet), Hofmann's violet, methyl green, methyl cosine, etc.

It may be advantageously substituted for the other methylic compounds employed at present, such as the bromide, iodide, and nitrate of methyl. The two former of these products are of a high price, especially the first mentioned, the use of which is now abandoned, and the last is extremely dangerous to work with on account of its explosible properties.

Liquefied chloride of methyl being pure and dry (that is, free from water), in virtue of its mode of preparation is perfectly adapted to the accurate determinations which lead to a perfect regularity in work.

For the preparation of certain methylic products, which are still made of heating muriatic acid with methylic alcohol, generally impure, we have by the use of the chloride of methyl a greater precision of reaction, and obtain the results at once in a state more nearly approaching to perfection.

The methylic products which have been hitherto obtained directly with liquid chloride of methyl are dimethylaniline, methyldiphenylamine, Hofmann's violet and methylaniline green.

We will say nothing concerning the simple preparation of the two former compounds, but will make a few remarks on the preparation of Hofmann's violet and of methyl green, according to the procedure of the firm of Mounet & Reverdin, of La Plaine, near Geneva.

To obtain green with chloride of methyl, place in an autoclave a solution of methylaniline violet in methylic alcohol rendered basic by means of soda, and close the apparatus after having introduced a determinate quantity of chloride of methyl. The autoclave is placed in the water bath heated by a jet of steam, and the temperature is raised to 203°, when the pressure reaches four to five atmospheres. When the reaction is terminated the hot water is run out of the water bath, and a current of cold water run in. The excess of pressure is destroyed by unscrewing a tap.

The product of the reaction, heated with an alkali, is filtered to separate the base of the violet; the filtrate containing the base of the green is then treated with an acid and a salt of zinc to form the corresponding double salt of green and of zinc, and the coloring matter is then precipitated with common salt.

By substituting rosaniline for methylaniline violet in the above operation we obtain Hofmann violet.—C. VINCENT (*Note on the Properties, Preparation, and Uses of Methyl Chloride*).

THEORY OF ALCOHOLIC FERMENTATION ACCORDING TO THE LATEST RESEARCHES OF CLAUDE BERNARD.

By C. BLONDEAU.

THE author seeks to establish the four following principles: The ferment exists preformed in the anterior of fermentescible bodies, and is not brought by the external air, in which it does not exist. The ferment is secreted by organized cells which have arrived at a certain stage of their development; it is soluble and acts in the manner of diastases, changing the constitution of bodies with which it is found in relation, decomposing them, and determining the combination of their elements in forms generally more simple than those which originally existed. The presence of air is necessary to the life of the ferment, which finds in atmospheric oxygen the excitation necessary to its development and to the maintenance of its existence. Oxygen intervenes not merely to excite the vitality of the ferment, but further to burn the alcohol produced in the act of fermentation, and to furnish in consequence of such combustion the animal or vegetable heat necessary for the exercise of vital functions.

DETECTION OF NITROBENZOLE BY A NEW PROCESS.

GLADSTONE and others have observed that nitrobenzole under the galvanic action of copper and zinc, and in the presence of water, is converted into aniline. On this fact they base the following mode of discovering small quantities of nitrobenzole. A few clean scraps of zinc are placed in about 5 c. c. of water, and about twelve drops of a concentrated solution of sulphate of copper is added. As soon as the liquid is thoroughly discolored, it is poured off, and the remaining metal well rinsed with water. Then a mixture of nitrobenzole and water is added, and heated for a few minutes to the boiling point. After filtering and cooling a few drops of a solution of chloride of lime are added, when the aniline will be developed. In this way 0·05 per cent. of nitrobenzole may be detected in a solution.—*Chemisches Centralblatt.*

SOLUBILITY OF PHOSPHORUS IN ACETIC ACID.

G. VULPIUS reports that, by digesting phosphorus for some time in concentrated acetic acid at a moderate heat, about $\frac{1}{10}$ of the weight of the latter is dissolved and kept in solution on cooling. If only a few drops of water are added, however, the solution becomes milky from deposited phosphorus, and when the addition reaches the volume of the solution used no phosphorus at all will be retained in solution.—*Archiv der Pharmacie.*

PREPARATION OF PURE ZINC.

ZINC absolutely free of iron and carbon is needed in reducing the salts of the oxide of iron before triturating with manganate of potassium. It may be prepared as follows: Commercial zinc is dissolved in muriatic acid, the solution treated with sulphureted hydrogen, and filtered. To oxidize the iron, the liquid is boiled with nitric acid, and then the oxide of iron precipitated by an excess of ammonia, so as to precipitate also a small quantity of zinc. After standing twenty-four hours the liquid is again filtered, evaporated to dryness, the chloride of zinc obtained, melted, and reduced by calcination in a clay crucible, after being mixed with chloride of sodium and sodium in the metallic state.—*Zeitschr. f. An. Chemie.*

CHEMICAL ITEMS.

CARUPANY is the rind of a tree growing in the La Plata regions. It contains from 22 to 25 per cent. of tannin.

ON Sept. 17th the works of the Rhenish-Westphalian Powder Company, situate at Ane, near Cologne, were destroyed by an explosion.

HEINZEMANN, of Bad Schwalbach, patents a procedure for obtaining anthraquinone from anthracene by means of chromic acid and the regeneration of the last-mentioned product.

HOMŒOPATHY.—According to Lord Jeffrey, "an ounce of medicine put into the Rhone at the upper end of the Lake of Geneva would physic all the Calvinists at the lower end."

TANNIN is said to be prepared in a liquid form at a manufactory at Elmira, New York. It is said to yield a fast black upon cotton, bears fulling, and is well adapted for fixing the coal tar colors.

RED ultramarine can be fixed in printing by means of albumen. Its color is not affected by boiling water, but steaming gives it a blue cast. It is of course discharged by acids, but is less affected by alum than blue ultramarine. The prospects for its extended use are but slight.

IN France 4,500 workmen are engaged in the manufacture of lamps, the value of the produce being thirty-five million francs annually. Four hundred dynamo-electric machines for the production of the electric light are now manufactured yearly in Paris.

ACCORDING to the *Zeitschrift des Oest Apotheker Vereins*, an ineradicable ink may be made by adding a concentrated solution of soluble Prussian blue to a common gall-nut ink. The characters can be effaced neither by acids nor alkalies.

PROF. REIMANN, speaking of the alleged adulteration of extract of logwood with the extract of galls, takes the same objection which we did. He points out that the poorest extract of galls is twice as expensive as the best extract of logwood.

THE mass which is left behind on the distillation of certain ores of mercury—a black, soft substance known as "Stupp"—has been examined by Goldschmidt, and is found to contain chrysene, phenanthrene, pyrene, a novel hydrocarbon, and also anthracene.

A RUMOR has been circulated that the *interior* of certain pasteboard cigar holders is colored green with an arsenical pigment. A contemporary doubts that any one would go to the trouble and expense of hiding arsenical green in the inside of cigar holders which are not green on the outside.

THE *Deutsche Wollengewerbe* describes an ingenious printing and embossing machine for woolen tissue, such as carpets and flannels. It consists of a press which prints with engraved plates. The pieces lie upon an iron table heated by steam, by which the fixation of the colors is effected in the moment of printing.

LAUR introduces the following improvement in the manufacture of sulphate of alumina. The crude sulphate being dissolved to separate the silica by decantation, the liquid is introduced into tanks containing sheet zinc, which precipitates the iron as a black powder, leaving the sulphate of alumina free.

A NEW tissue is said to be made out of cotton by the following process:—The clean cotton is soaked for 24 hours at 112° F. in a mixture of one part of sulphuric acid, one part sulphoglyceric acid, and three parts of water. It is then passed between glass rollers, washed and dried. Cotton thus prepared assumes in part the attributes of wool, and can be dyed as such.

A NEW color is coming into use in Belgium under the name of "National Blue." Its composition has not yet been made public, but it is said not to be a product of aniline. It is soluble in water, and is used along with a little sulphate of soda and a little sulphuric acid, dyeing at a boil. It is said to have the advantage of not soiling whites, etc , and certainly the samples which have reached us do not stain white paper, even on severe friction.

IN the *Färber Zeitung* a question is raised concerning the nature of "hypernic," a substance often mentioned in American dyeing receipts. In the *Handbook of Dyeing and Calico Printing*, by W. Crookes, F.R.S., we find the following note:—"Peachwood liquor is sometimes termed, chiefly in America, hypernic. The term is derived from Nicaragua wood, 'hyper' being added to denote a superior quality of the liquor."

AN ox yields on the average 83 kilos (1,000 kilos = 1 ton) of crude tallow, which, when worked up, yields 18 kilos of butyrene (fraudulently sold as butter); 24 kilos of stearic acid, sold partly as such, and partly in the form of candles, either alone or mixed with solid paraffin; 23½ kilos of oleic acid, sold as such, or in the form of soaps; 2½ kilos of refined glycerine, partly sold as such, and partly used in the manufacture of soaps, toilet articles, and medicinal preparations, and sometimes applied in the adulteration of wines. There remain about 16½ kilos of refuse, used as manure. —*Zeitschr. f. Chem. Grossgewerbe.*

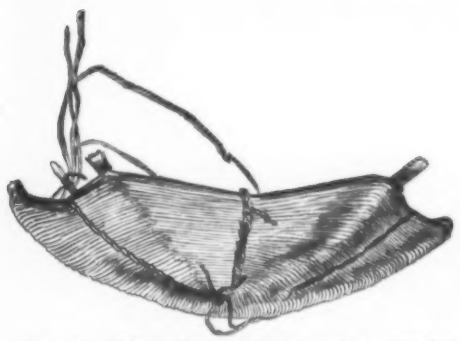


FIG. 10.—WOOLEN THREADS ON A FRAME.

FIG. 13.—BRONZE KNIFE FROM ANCIENT GRAVE, PERU. (Natural Size.)

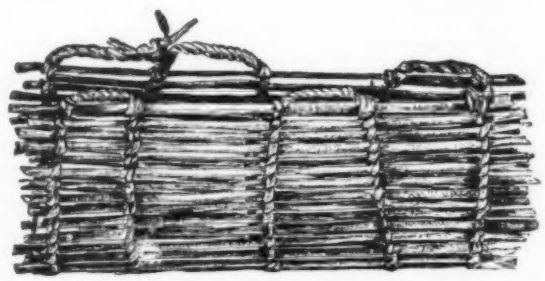


FIG. 16.—STICKS BOUND WITH CORDS, FROM ANCIENT GRAVE, PERU.

[Continued from SUPPLEMENT No. 151, page 2407].

NOTES ON A COLLECTION FROM THE ANCIENT CEMETERY AT THE BAY OF CHACOTA, PERU.*

By JOHN H. BLAKE.

BESIDES the articles before enumerated, there were found in the tomb a package of coca done up in a brown cloth and a number of woolen bags, of various patterns and sizes, some of them containing maize, both ground and unground, and others leaves of coca. Several of these bags are of fine and even texture, with ingeniously-woven figures of various patterns and colors. Many of them are much worn and have been neatly repaired. Each bag is made of a single piece of cloth, woven of the exact size required for the purpose for which it was intended, and this remark is applicable to every article made of cloth which was found in the cemetery.

FIG. 11.—SPINDLE WITH WHORL OF STONE.

The fabric is generally evenly woven, often fine and soft, of threads dyed with durable colors consisting of two or more strands. The sewing is generally strong, uniform, and often ornamental. One of these bags contained a long cotton cord formed of nine strands, evenly twisted together and as uniform throughout as if made by means of modern machinery. It is noticeable as being almost the only article made from this material which was found.

Another bag, of fine texture, differing in pattern from the rest, contained five locks of human hair and a single bead formed of *Chrysocolla*. This hair is fine and does not appear to have undergone any material change of color; it is of several shades of brown in all the locks excepting one, which is black.

If, as some have supposed, the hair on the mummies, now brown, was originally black and had changed by age, why should not this lock of black hair have changed also?

Other articles found in the tomb were: A piece of unfinished work, of woolen threads of various colors, upon a rude frame made of twigs; this is shown in Fig. 10; with it there were a thorn needle with a piece of thread still in the eye and three balls of yarn. From its having been found in connection with the body of the woman, it is not improbable that it is a piece of work upon which she was engaged a short time before her death. Similar pieces of unfinished work were found in other tombs; for what they were designed is unknown, possibly for caps like the one which has been described. Several spindles and distaffs of wood and one of wood and stone were found; one with a stone whorl is represented by Fig. 11. These simple instruments for spinning by hand are in common use at the present day, and weaving is still done, to some extent, by Indian women who have no knowledge of the loom; the warp being held by stakes driven into the ground, and the woof inserted under and over the threads by means of a long wooden needle.

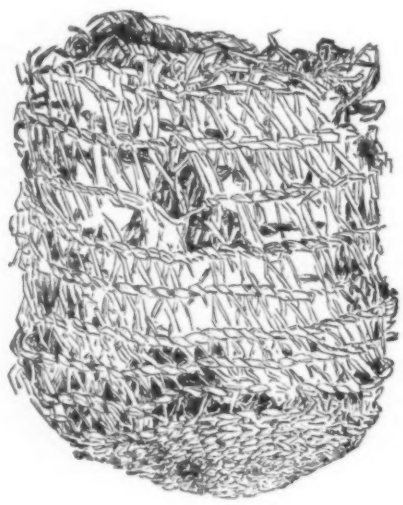


FIG. 17.—BASKET FROM ANCIENT GRAVE, PERU. (Natural Size.)

The only articles of metal found in this tomb besides the silver disk, before mentioned, were two knives of copper alloyed with a small percentage of tin, each formed of a single piece of metal, with the handles in the middle of, and at a right angle to, the blade; in one of them, Fig. 12, the end of the handle represents the head of a *Llama*. The blade of the largest, Fig. 13, is two and a half inches long and five-eighths of an inch wide; the handle measures two and a half inches from its end to the edge of the blade. There were three combs, similar to the one before mentioned; one of these is represented in Fig. 14. The teeth, each of which is formed of a separate piece of hard wood, are bound together between two semi-cylindrical pieces of wood by thread. Several ears of corn or maize, of a peculiar kind. The receptacle is remarkably small, the grain long and cylindrical, and the farinaceous portion nearly free from oil. All efforts to make it vegetate have proved unsuccessful. A thorn needle with an eye and a thorn, such as the needles were made of. A small pointed stick showing marks of fire. Six pointed sticks of various sizes and shapes, and five larger pointed sticks of different shape. Three knives, or possibly arrows, Fig. 15, actual size, made of stone and fixed in short wooden handles, or shafts, pointed at the end as if for insertion in a reed. Two peculiar articles made of small sticks bound

FIG. 15.—STONE KNIVES.

together by cross cords in a peculiar manner, Fig. 16. Two small open-work baskets made of split reeds, Fig. 17. Small and beautifully made basket of reeds, Fig. 18. A piece of unfinished work, like that described in a previous part and represented by Fig. 10. Foot of a bird prepared in a peculiar manner, somewhat like a bottle with a wooden

* From the Eleventh Annual Report of the Peabody Museum of Archæology and Ethnology, Cambridge, Mass., where the specimens figured and referred to are on exhibition

FIG. 12.—BRONZE KNIFE FROM ANCIENT GRAVE, PERU. (Natural Size.)

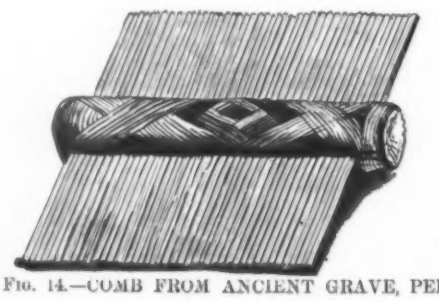


FIG. 14.—COMB FROM ANCIENT GRAVE, PERU.

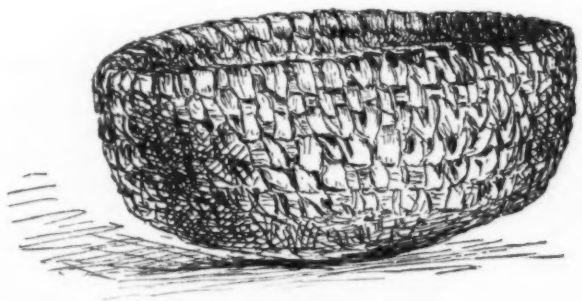


FIG. 18.—BASKET FROM ANCIENT GRAVE, PERU. (Natural Size.)

FIG. 20.—CLAY VESSEL FROM ANCIENT GRAVE, PERU.

stopper. A small twig bound with fine thread and having the appearance of a miniature bow, perhaps a child's plaything. Two lots of wool of the *Vicuna*. A small gourd bottle ornamented about the mouth.

Besides the articles enumerated, there are a number of earthen vessels, of which several are represented in the following figures, both glazed and unglazed; some are plain and

FIG. 21.—CLAY VESSEL FROM ANCIENT GRAVE, PERU.

others are ornamented. They were moulded by hand without the aid of a potter's wheel. One of them, Fig. 19, rudely represents a bird; similar vessels have been found unbroken, which, when filled with water and rocked forward and backward, emit a sound not unlike the note of a bird.

Fig. 20 represents a beautiful jar, in which the bowl part is supported by the head and horns of a deer.

FIG. 24.—CLAY VESSEL FROM ANCIENT GRAVE, PERU. (Natural Size.)

Another symmetrical and beautiful vessel of clay is that represented by Fig. 21. Still another vessel of the same general character of pottery, but not so symmetrical, is shown, of natural size, in Fig. 22.

These several examples of ancient Peruvian ceramic art are made of fine clay and well finished. The ornamentation

FIG. 19.—CLAY VESSEL FROM ANCIENT GRAVE, PERU. The pattern on the wing, enlarged twice.

is in black and white paint on a red ground, or, as in the case of Fig. 22, black and red on a brownish ground.

An interesting clay bowl is shown in Fig. 23. This bowl is well made and carefully finished, and, as shown in the figure, is ornamented on the inside by two black lines of border, under which are represented three birds.

Fig. 24 represents, of natural size, a peculiar pointed little

FIG. 22.—CLAY VESSEL FROM ANCIENT GRAVE, PERU. (Natural Size.)

vessel of black clay, and Fig. 25, also of natural size, a small rudely-made pitcher-shaped vessel.

Several other vessels of clay were collected and are with the collection.

Spherical vessels, such as are represented in the drawings, are used in Peru at the present time for preparing a kind of

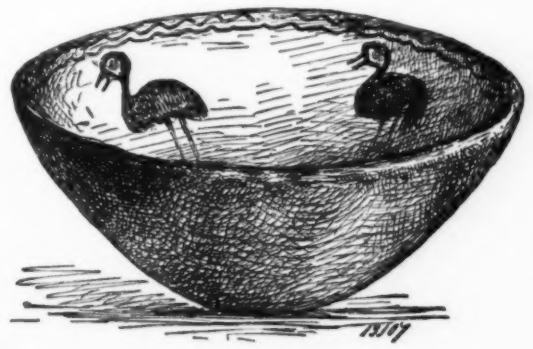


FIG. 23.—CLAY BOWL FROM ANCIENT GRAVE, PERU.

tea from leaves of coca, which is used for medicinal purposes, and sipped by means of a small tube passed through the hole in the top.

The crania found in the cemetery, and the remark applies equally to those found in other similar cemeteries, present two distinct forms, the one rounded and the other elongated. Those of the bodies described are of the former shape. A large number were collected and brought together, and from them a selection of a few of each kind was made, in order to obtain fair average specimens of each type.

The rounded, *brachycephalic*, crania are small. The occipital bone is flat; the forehead retreating, but elevated and broad in comparison with that of the elongated, *dolichocephalic*, crania. The temporal fossa is not remarkably large. When the eye is directed downward upon these skulls, the occiput being toward the observer, the zygomatic arch is nearly, in most, and entirely, in some of them, hidden from the sight. Viewed in the same position, the face is completely hidden by the upper and front part of the cranium. The orbital cavities are deep and their margins quadrangular. The bones of the nose are prominent and the orifices large. The alveolar edges of the jaws are obtusely arched in front and the chin projects on a line with the teeth. The cheek bones descend in nearly a straight, vertical line from the external angular process of the frontal bone. Compared with the elongated crania, the face is small and its outlines more rounded. The following are measurements in inches from four, which were selected as fair average specimens of this type:

Longitudinal diameter	6·	6·3	6·6	6·7
Parietal diameter	5·2	5·	5·3	5·3
Frontal diameter	3·5	3·5	3·4	3·6
Vertical diameter	5·2	5·3	5·3	5·4

Of the other type of crania, the elongated, *dolichocephalic*,

Fig. 25.—CLAY VESSEL FROM ANCIENT GRAVE, PERU. (Natural Size.)

Fig. 28.—CRANIUM OF A CHILD FROM ANCIENT GRAVE, PERU, NORMAL.

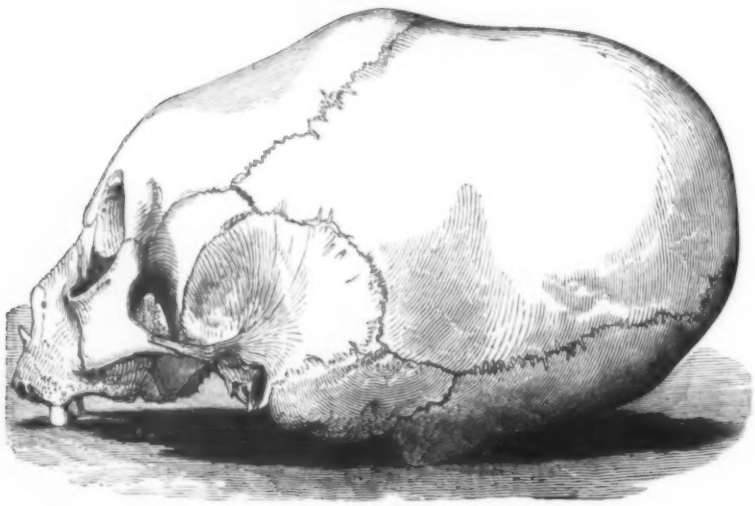


Fig. 26.—CRANIUM OF A CHILD FROM ANCIENT GRAVE, PERU, ABNORMAL.

Fig. 29.—CRANIUM OF A CHILD FROM ANCIENT GRAVE, PERU, NORMAL.

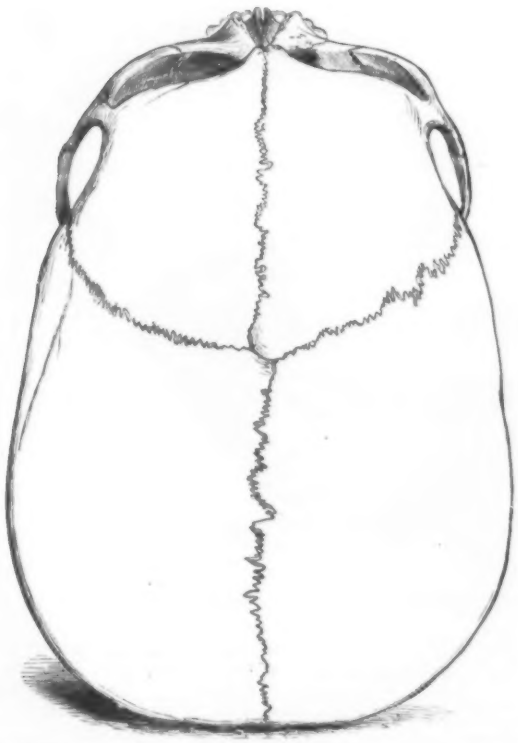
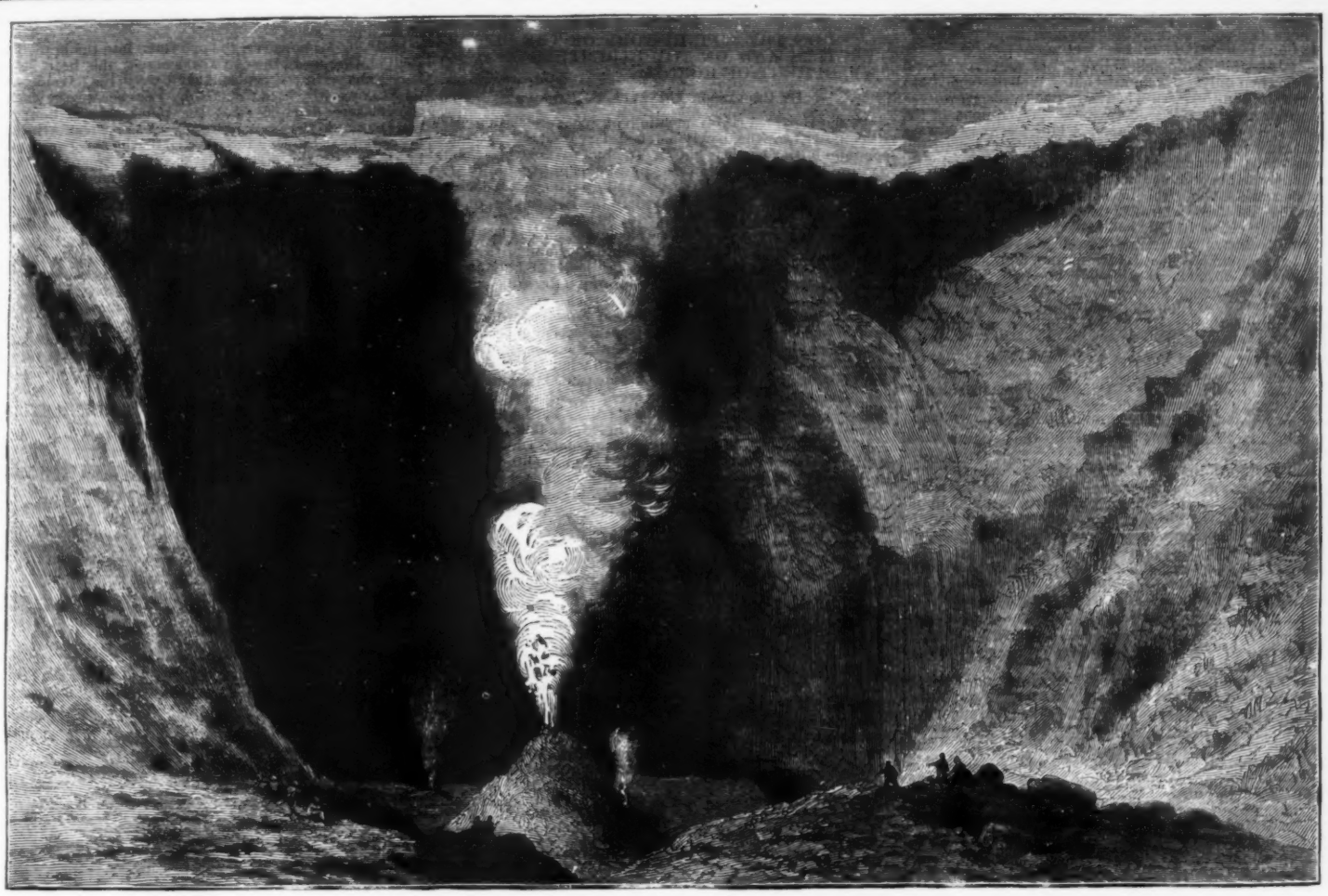


Fig. 27.—CRANIUM OF A CHILD FROM ANCIENT GRAVE, PERU, ABNORMAL.

Fig. 30.—MUMMIED HEAD FROM ANCIENT GRAVE, PERU.



THE HOT SPRINGS OF LAKE HOPE, WHITE ISLAND, NEW ZEALAND.

full two-thirds of the cavity occupied by the brain lies back of a vertical line drawn from the middle of the occipital foramen, and, when laid upon a table, resting on the condyles, the skull falls backward. The forehead is low and very retreating. The temporal ridges approach near to each other and a large space is afforded for the temporal muscles, between which the skull seems compressed. Compared with those before described, the whole bony apparatus of the face is more developed. The zygoma is stronger and more capacious; the superior maxillary bone is more prolonged in front, and its incisor teeth are in an oblique position. The entrances to the nose are more ample and the cribriform lamella more extensive. The substance of the skull is thicker and the weight greater. In these, also, the orbital cavities are deep and the margins quadrangular. In both the foramen magnum and the other openings for the passage of the nerves are large. The following measurements in inches were taken from three fair average specimens:

Longitudinal diameter	7·2	7·3	7·
Parietal diameter	5·2	4·9	4·7
Frontal diameter	3·6	3·3	3·2
Vertical diameter	5·1	4·9	5·1

These measurements average for each type—

	Brachycephalic.	Dolichocephalic.
Longitudinal diameter	6·4	7·1
Parietal diameter	5·2	4·9
Frontal diameter	3·5	3·3
Vertical diameter	5·3	5·

Figs. 26–29 represent, of about two-thirds their natural size, the skulls of two children, of from five to six years of age, both of the dolichocephalic or elongated type. One of these, Figs. 26, 27, shows evident marks of artificial distortion, and the other, Figs. 28, 29, evident indications of its normal shape.

In the former an unnatural ridge is seen near the coronal suture, and the parietal bones bulge out on either side. No similar peculiarities are to be seen in the latter.

The differences which have been shown in the crania are by no means the only differences between the two classes. Other parts of the skeletons when compared show a striking dissimilarity. All the bones belonging to the elongated or dolichocephalic type of crania are larger, heavier, and less rounded than those belonging to the other, or brachycephalic type, and their processes are more protuberant; the hands and feet are larger, and there is every evidence of their general greater muscularity, showing that they were fitted for, and accustomed to, manual labor, the reverse of which is indicated by the narrowness and delicacy of the hands and the long and regularly formed finger nails of those to whom belonged the rounded or brachycephalic crania.

In one of the tombs in the same cemetery, in which were several bodies, there was found, deposited separately, a well-preserved head, Fig. 30, wrapped in a thick cotton hood. It is in a good state of preservation, and this appears due to careful desiccation without the use of resin or other antiseptic. From the manner in which the skin of the neck is drawn inward over the *atlas* and *dentatus*, it is evident that the preservative process was applied to the detached head soon after death. No other separate or similarly formed head was found. In some respects it presents striking points of dissimilarity to any of the crania already described. It is remarkable for its great height compared with its diameter. Measured from the most prominent part of the frontal bone to the extreme projection of the occiput, it is 6·4 inches; from the most prominent protuberances of the parietal bones the diameter is 5·8 inches, and vertically, from a horizontal line drawn across the center of the orifice of the ear to the highest part of the head, is 5·2 inches. The forehead is broad and high, the nose prominent, the cheek bones high, the alveolar edges of the jaws obtusely arched in front, and the incisor teeth stand in a vertical position. The hair, which is brown and slightly gray, is remarkably fine, with a tendency to curl. It has been neatly braided, and several of the braids are passed across the forehead, for which purpose they have been lengthened by the addition of false hair, so ingeniously joined as nearly to escape detection. The orifices of the ears are filled with tufts of cotton, and the same are passed through slits in the lobuli. The teeth in this head, and all in the adult skulls examined, including those under middle age, are much worn. The incisors are ground down from their cutting edge to a broad, flat surface, and the cuspidati present a similar appearance. Though this condition is very common in the crania of primitive races, it is accounted for among the Peruvians by a habit, still prevalent, of chewing the leaf of the coca, mixed with a gritty substance called *llute*, made of the wild potato, calcined shells, and ashes of cacti, or other plants rich in alkali.

HOT SPRINGS, WHITE ISLAND, NEW ZEALAND.

THIS remarkable island is situated in the Bay of Plenty (Province of Auckland), about fifty miles north-east of Tauranga, where a famous fight with the Maories formerly took place. The island derives its name from the clouds of white steam in which it appears, to passing mariners, to be continually enveloped. Its area is only about 600 acres, while its height is about 880 feet above the level of the sea. It resembles in form and color a reposing camel, while the interior, with its gray, weather-beaten, almost perpendicular cliffs, recalls the Coliseum at Rome. Deep water exists close into the beaches, which are studded with large water-worn bowlders, as shown in the above engraving. Overhanging the southern landing place stands a column of rock, closely resembling a sentinel, which the owners of the island, Messrs. Wilson and Troup, have dedicated to the immortal memory of Captain Cook. Proceeding inland, across the flat, which is principally composed of gypsum impregnated with sublimed sulphur, and everywhere perceptibly warm even through the thickest boots, the traveler reaches Lake Hope. Here the fumes of sulphur are plainly perceptible by nose, palate, and eyes; while the ear is treated to a sound like the roar of Niagara Falls. The water is of a pale green hue, and is strongly impregnated with muriatic acid. In fact, when boats are placed upon this lake for the purpose of approaching the active geysers at the opposite side, the nails in their bottoms are carefully examined to make sure that they are of copper, and not of iron; and wearing apparel, when dipped in this water, at once turns a brick-red color, and shortly after parts company with the rest of the garment. The depth of the water is about 12 feet, and the temperature 110°. The mouth of the biggest geyser is about 12 feet across. The lake is surrounded by black liquid mud, dangerous to walk upon. Four feet below the surface a temperature of 200° was attained. The steam from the various craters rises over the highest point of the island, and the particles of sulphur ejected from these craters along with it fall again, like yellow soot, into the lake itself. Near one of the geysers are found immense blocks of pure sulphur, honeycombed and blistered, and still warm when chipped off and hauled into the boat. These exactly resemble lumps of yellow coal, and fetch the same price as the "roll" sulphur of commerce, being pronounced equal to the finest Sicilian or Spanish product. On a fine moonlight night an awe-inspiring spectacle is afforded to the visitor who sits in a boat in the middle of this placid, but treacherous lake. Around him for fifty acres extends an immense caldron, hissing and snorting, and belching forth volumes of poisonous steam, while all chances of egress appear to be denied by the steep, silent, and gloomy cliffs which encircle these enchanted waters. Our engraving is from a photograph by Mr. Collie, of Napier, N. Z.—*London Graphic.*

[Abstract.]

ON THE LARVAL CHARACTERISTICS OF CORYDALUS AND CHAULIODES, AND ON THE DEVELOPMENT OF CORYDALUS CORNUTUS.

By PROF. C. V. RILEY.

THE paper relates to the development of one of the most singular and interesting of North American insects—the largest of the order Neuroptera. In its perfect state this insect is a great, clumsy, nocturnal fly, popularly called Hellgrammite, and characterized by the jaws of the male being converted into a pair of long, curved, cylindrical and tapering prehensile organs, like the finger of a grain cradle. In the larva state it is aquatic and much esteemed as fish bait by fishermen, who call it a "crawler," "dobson," etc. Indeed, one of the most popular artificial fish baits is a patent India rubber imitation of it. This larva is very peculiar in having in its latter stages three distinct sets of breathing organs, viz.: the ordinary spiracles, a lateral series of long, single branchial filaments, and a ventral series of spongy branchiæ, composed of numerous branching and tractile filaments. The eggs of this insect are laid, to the number of about three thousand, in curious masses on the leaves and branches of trees, or upon any other object overhanging water, and were first described by Mr. Riley at the Buffalo (1876) meeting of the Association. After comparing the eggs with those in the female abdomen, and the newly hatched with the mature larva, he felt quite certain as to the parentage of the curious eggs. Yet the newly hatched larva which he described differed from the mature larva in lacking the ventral branchiæ, resembling in this respect the mature form of another aquatic larva of an allied genus (*Chauliodes*), and as some leading entomologists believed that the eggs described by Mr. Riley might belong to this last genus, further evidence as to the real nature of said eggs was desirable. The paper presents this evidence and confirms the previous determination. The *Corydalus* larva is traced through its stages of growth and then compared with that of *Chauliodes*. Several interesting scientific facts are brought out. The larva undergoes about six moults. The double nature of the thoracic tracheæ in *Corydalus* appears in the first larval stage, and the branchial nature of the lateral filaments is proved by the tracheæ leading to their tips. The ventral branchiæ first appear in the second stage (after first moult), and from three main stems, each with bifurcate or trifurcate filaments. The branching filaments become more and more numerous and complex with each moult. The tracheæ also lead more and more strongly to these ventral branchiæ and less strongly to the lateral ones, with age. The stigmata are obsolete in the first three stages, and in the fourth are only clearly distinguishable on the four or five larger abdominal joints, being still obsolete on the terminal ones.

The motion of the larva is invariably backward. When newly hatched it moves actively about in the water by sudden sweeps of the abdomen beneath, very much as a lobster is known to do; and even, when full grown, a somewhat similar motion is employed in swimming. In the water a constant motion of the ventral branchial tufts is kept up, the main stem being first moved quickly backward and upward so as to bring the whole tuft close to the body, the filaments of which it is composed being then closely appressed to each other. The main stem is then brought more slowly down in the opposite direction, when the filaments spread and enlarge

the whole to its utmost. In pure water the motion occurs about once a second; as the water becomes impure the motion becomes more rapid, and the larva issues from the water as soon as possible, being able to live out of water for several days even when only a few months old. Well developed ova are found even in the larva when only two-thirds grown.

The paper gives detailed comparative descriptions of the *Corydalus* and the *Chauliodes* larvæ. This last may always be distinguished from the former by having a smooth and unarmed skin; that of *Corydalus* has a skin roughened with granulations and capitate or clavate projections (overlooked by previous describers), the little projections being visible even in the first stage, at which time they are less capitate. The *Chauliodes* larva has the last pair of spiracles on the tips of a pair of contractile filaments, described as setæ by Walsh, who failed to apprehend their real nature, and wrongly described the *Chauliodes* larva as having one pair of spiracles less and one abdominal joint less than that of *Corydalus*, whereas both larvæ have the same number of joints and spiracles and both possess the rudimentary mesothoracic spiracle, which Mr. Riley finds more common in insects than is generally supposed. In other structural respects, as well as in habits and transformations, the two larvæ greatly resemble each other. The eggs of the *Chauliodes* have a longer tubercle or stem on the top, and are not covered with white albuminous material as are those of *Corydalus*. Mr. Riley has obtained large additional numbers of the egg masses of the latter the present summer, finding them not only on the leaves as described in his former paper, but on the stems of different trees, as well as on rocks overhanging water. He has had as many as twenty egg masses on a single maple leaf, both sides of the leaf being completely plastered up by them; and as a large number of these masses will generally be found in some one particular locality, or on a few branches of the same tree, the assumption is that the females congregate for purposes of oviposition. The white, albuminous substance covering these eggs shows by analysis that it has all the physical properties of wax.

THE MONKEY QUESTION IN INDIA.

A MONKEY campaign threatens to complicate the Asiatic question. It appears that within eight miles of Calcutta a detachment of baboons have lately taken forcible possession of the village of Augurpara, on the high road to the military station of Barrackpore, and, having ejected by violence and intimidation all the more human inhabitants, have billeted themselves on the orchards and gardens of the hamlet, whence they direct offensive strategetic movements, night attacks, and predatory raids upon the neighborhood. In many points these simian marauders resemble their prototypes in Bulgaria, for we are told that "they are great brutes, and as savage as wild beasts. They attack children, and even full-grown women without fear, selecting always the female and weaker sex as the special objects of their violence." Fortunately, however, Calcutta is close by, and the local volunteers will, it is hoped, suffice to suppress the outbreak and drive the insurgent apes back to their jungles, thus obviating the necessity of calling out the regular troops and saddling India with additional military expenditure.

Meanwhile the fact remains that the residents of Augurpara have deserted their homes *en masse*, and that the apes are in riotous possessions of the plantain trees and the guava orchards, and reveling on the mangoes and other fruits now all ripe. Whether good may not come out of this evil, and the vagrant baboon, having made experience of the advantages of civilization, may not eventually come to prefer a settled life, and take to husbandry, is an interesting speculation we cannot here discuss.

Troublesome the Indian monkeys have been from the first, and local administration is constantly confronted with problems of a puzzling nature, in consequence of the objectionable tendency to intrude which characterizes them, and the sentimental veneration in which they are held by the people. The monkey, in the first place, has no self-respect; he thrasts himself into all companies, performing all domestic duties under the public eye, while scorning to recognize any of the niceties of the minor ethics. The average Christian, therefore, considers him a nuisance, and the ape never succeeds in effecting a lodgment on the premises of Europeans in India. The Hindoo, however, even though he may deplore the monkeys' shortcomings, is shackled by his religious scruples in his conflict with them, and dare not openly affront the creatures.

In many cities of India the monkeys inhabit recognized quarters, and are allowed every morning to descend from temple top and tree into the market place, and there to eat their fill of whatever may be exposed for sale. The owner sits by, pretending to grant the meal without grudging, but when no one else is looking he often takes the opportunity of giving the intruder a hearty cuff to send it on to the next stall for the rest of its breakfast. This semi-sacred character complicates the problem before the magistrate, for if one street complains to him that the monkeys have mischievously picked half the tiles off the house and begs to have them deported, the next street petitions that their religious prejudices may not be outraged by any interference with the simians' liberty. Sometimes, however, whole towns agree that the monkey nuisance has become intolerable, and, gods or not, vote for wholesale deportation. But the monkeys are as astute as their neighbors, and though submitting to be coaxed across the river, or carted off to a neighboring jungle, utilize both ferry and high road traffic for a speedy and comfortable return. Between Benares and Ramnagar a constant transportation of monkeys was at one time carried on; but since as many came back by boat of their own accord—the ferryman not daring to refuse their wishes—the local official abandoned the enterprise, and to this day the animals share both city and palace with the human inhabitants.

In the hill districts whole fields of corn are ravaged in a morning by the long-tailed troops, but the superstitious villager will not do more than shout at them his respectful request to go away. To catch them would do no good, and kill them he dare not, so he abandons his grain cultivation altogether for a year, and the monkeys pass on to another village. In the plains of India, from one sea to the other, representatives of the family are found, and command everywhere a similar respect. Their images in mud, marble or metal, are exposed for sale in every idol shop, and though not actually worshiped, are sufficiently reverenced to find a place on every altar and in almost every temple.

The villagers of Augurpara have therefore succumbed to no despicable foe, for the task of driving three hundred sulky baboons out of a village without outraging religious sentiment is a task calling for considerable tact, and not a little strategy.—*London Telegraph.*

SUPERHEATED steam is extensively used in soap-boiling in France.

[Abstract.]

NOTES ON THE LIFE HISTORY OF THE BLISTER BEETLES AND ON THE STRUCTURE AND DEVELOPMENT OF HORNIA.

By PROFESSOR CHARLES V. RILEY.

AT the Hartford (1874) meeting of the Association, Mr. Riley described the newly-hatched larva of some of our common blister beetles; but all attempts to trace their habits had proved futile both in this and other countries until 1877, when he discovered that they preyed on the eggs of locusts (*Acrididæ*). In a paper published in the last volume of the "Transactions of the Academy of Sciences of St. Louis," the life history of several of our common blister beetles is traced. The present paper gives a brief résumé of the facts there recorded, showing that the beetles belonging to the genera *Epicauta* and *Macrobasis* go through the same curious hypermetamorphoses as do other species of the family *Meloïdæ*, and especially as *Meloë* and *Sitaris* were already known to do. The larva hatches as an active, pale brown, long-legged creature, termed triangular on account of its three-clawed tarsus. It then changes to what Mr. Riley calls the *Carabidoid* stage, in which it is white, less active and fleshy; then to what he calls the *Scarabæidoid* stage, in which it is still more degraded and clumsy; then hardens to what he calls the *Coarctate larval* stage, in which it is perfectly helpless, and resembles the *puparium* of many Diptera; then to the final larval stage, in which it is again white and soft, and more or less active; then to the true pupa state; and, finally, to the beetle; existing, thus, in eight distinct states (including the egg), instead of the four in which ordinary insects occur.

The paper is principally devoted, however, to the life history of a very anomalous, wingless genus of this family, the *Hornia minutipennis*, Riley. This insect is degraded and subterranean, and was found in the cells of a common mason bee, the *Anthophora abrupta*, Say. Its life-history, which was not known at the time the species was described, has been completely made out by Mr. Riley the present summer. The eggs, which are laid loosely in the burrows of the bee, hatch during the early part of June. The triungulin is extremely active, and, in all essential characters, very similar to that of *Sitaris*, one species of which, in Europe, likewise develops in the cells of *Anthophora*. By means of its tarsal claws and of a pair of preanal spinnerets and claspers, it holds on very tenaciously to the hairs of the bee, and is carried on the same into the bee-burrow. When the bee-egg is laid, and before the cell is capped over, this triungulin disengages itself from the bee, and at once pounces upon the bee-egg. After having sucked the contents of this last it throws off the triungulin skin and assumes the *carabidoid* stage; thereafter feeds upon the honey paste stored by the bee, and, within the cell, goes through all the hypermetamorphoses characteristic of the family. All the later stages, however, take place within the puffed skin of the *scarabæidoid* larva, the *coarctate* larva being well separated therefrom, but the third or final larva having such a delicate skin that it is not easily separated from this last when shed. There is but one brood annually; the pupa state being attained in August, and the beetle maturing all its parts during the autumn, and lying within its numerous coverings until the following May.

The paper contains some interesting details as to the effect of rain both on the bee larva and the *Hornia* larva; on the vicissitudes that befall the triungulin, its fratricidal propensities when two or more are inclosed in the same cell, and on its adaptability to food-supply.

[Abstract.]

BIOLOGICAL NOTES ON THE GALL-MAKING PEMPHIGINÆ.

By PROFESSOR CHARLES V. RILEY.

THE life-history and agamic multiplication of the plant-lice (*Aphididæ*) have always excited the interest of entomologists and even of anatomists and embryologists. The life-history, however, of the gall-making species belonging to the *Pemphiginæ* has baffled the skill of observers more than that of any other group.

Mr. Riley is about to publish some new biological discoveries relating to this family of insects, in connection with a descriptive and monographic paper by Mr. J. Monell, of the St. Louis Botanic Gardens. The paper laid before the Association simply records some of the yet unpublished facts discovered.

All of the older writers in treating of the different gall-producing *Pemphiginæ* of Europe have invariably failed to trace the life-history of the different species after the winged females leave the galls, and, with few exceptions, have erroneously inferred that the direct issue from the winged females hibernates somewhere. The most recent production on the subject is a paper published the present year in Cassel, Germany, by Dr. H. F. Kessler, entitled the "Life History of the Gall Making Plant Lice affecting *Ulmus campestris*." The author, by a series of ingenious experiments, rightly came to the conclusion that the insects hibernate on the trunk, but he failed to discover in what condition they so hibernate.

Led by his previous investigations into the habits of the grape phylloxera, Mr. Riley discovered, in 1872, that some of our elm-feeding species of *Pemphiginæ* produce wingless and mouthless males and females, and that the female lays but one solitary impregnated egg. Continuing his observations, especially during the present summer, he has been able to trace the life history of those species producing galls on our own elms, and to show that they all agree in this respect, and that the impregnated egg produced by the female is consigned to the sheltered portions of the trunk of the tree and there hibernates, the issue therefrom being the stem-mother which founds the gall-inhabiting colony the ensuing spring.

Thus the analogy in the life history of the *Pemphiginæ* and the *Phylloxerinæ* is established, and the question as to what becomes of the winged insects after they leave the galls is no longer an open one. They instinctively seek the bark of the tree and there give birth to the sexual individuals, either directly, or (in one species) through intervening generations.

WHY THE FLOUNDER IS UNSYMMETRICAL.

IN the proceedings of the American Academy of Arts and Sciences, Mr. Alexander Agassiz discusses the question how the eyes of the flounder come to be placed both on the same side of the head. It appears that the young flounder immediately after it is hatched, does not differ from other fishes; but, very early in life, as observed in eight species, one eye begins to pass over the frontal bones, from the pale to the dark side of the animal, by a combined process of translation and rotation.

In *Plagusia*, however, the eye sinks into the head, the old orbit closing up as the eye works across the head, until at length the right eye gets entirely over to the left side. Attention has recently been directed by Pouchet to the fact that the absence of color from the blind side of flounders is plainly due to the partial atrophy of the great sympathetic nerve, effected during the passage of the eye from one side of the head to the other. It has been suggested that the cause of asymmetry in the animal kingdom is due to a difference in the strength of the organs of sense; to this Mr. Agassiz adds that in some hydroids, where the disproportion of one of the organs of sense is very great, the entire animal is unsymmetrical. Moreover, the action of light, he remarks, upon the organs of sense, which in all embryos are developed out of all proportion to their ultimate conditions, must remain an all important element in its effect upon the nervous system. In this connection, it may be stated that Pouchet has succeeded in producing a white side in trouts by destroying the eye of that side of the fish. The bearing of such facts as these on the general subject of protective mimicry is discussed by Mr. Agassiz.

SOME FURTHER FACTS REGARDING THAT "FATHERLESS RACE."

By PROFESSOR C. V. RILEY.

I AM led to send you a few additional notes on the curious bag-worm (*Thyridopteryx ephemeræformis*) by the receipt of a recent letter from Mr. William H. Gibson, part of which I herewith extract:

DEAR SIR:—I return from an extended vacation to find your welcome answer to my communication in the SCIENTIFIC AMERICAN relative to that "fatherless and motherless race." I presume you have enjoyed a good laugh at my expense in that matter, and from your standpoint I do not blame you. Please accept my earnest thanks, *personal thanks*, for the complete and satisfactory treatment of the subject. . . . That bag worm had been a continued source of aggravation to me for several years, and I determined at last to publish my experience with the creature, in the very hopes of finding somebody who would be able to solve the problem. I wrote to Professor Baird, at W., several years ago on the subject, but never received a reply. . . . In reference to the act of impregnation, you say, "she patiently awaits the male, and after meeting him," etc. It is of course assumed that the male inserts his organ through the opening of the cocoon, and thus accomplishes the connection.

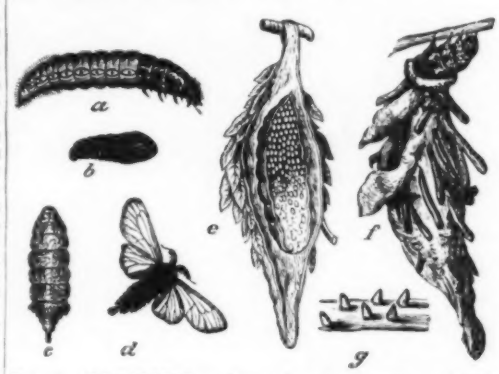


FIG. 1.—BAGWORM: *a*, larva, *b*, male chrysalis; *c*, female moth; *d*, male moth; *e*, follicle and puparium cut open to show eggs; *f*, worm crawling with bag; *g*, young worms with their conical upright coverings.

In my former communication I merely stated the fact of coition, without in any way explaining the process; but as there may be others who, like Mr. Gibson, are still somewhat puzzled as to the manner in which the male manages to meet his mate, to all appearance so effectually hidden and excluded from his reach; and as the process is singular enough, and not generally understood even by entomologists, a few additional words of explanation seem desirable to supplement what was previously said.

We have seen that by means of the elongation of her puparium, and her partial extraction therefrom, the female is able to reach with her head to the extreme lower end of her follicle, causing, in doing so, the narrow elastic portion

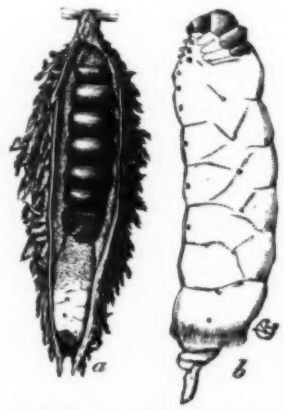


FIG. 2.—BAGWORM: *a*, a follicle cut open to show the manner in which the female works from her puparium and reaches the end of the bag—natural size; *b*, female extracted from her case—enlarged.

of the follicle to bulge, and the orifice to open more or less, as it repeatedly did while the larva was yet feeding, whenever the excrement had to be expelled. Fig. 2, *a*, shows a follicle, natural size, cut open so as to exhibit the elongated puparium, and the female extended from it as she awaits the male; *b*, represents this degraded female, about thrice enlarged. A cursory examination of the male shows the genital armature (which is always exposed) to consist of (1) a brown, horny, dorsal, bilobed piece, broadening about the middle, narrowing to and notched at tip, concave, and furnished with a tuft of dark hairs at tip inside; (2) a rigid, brown sheath, upon which play (3) the genital hooks or clasps, which are also concave inside, strongly bifid at tip, the inner finger furnished with hairs, the outer produced to an obtuse angle

near tip, and generally unarmed (Fig. 3, *c*). In repose this armature appears as at Fig. 3, *c*, from beneath, and as at *d* from above, and is well adapted to prying into the opening of the follicle. The male abdomen is telescopically extensile, while the tip easily bends or curves in any direction, but most naturally beneath, as at *b*, where it is represented about six times enlarged, and with all the genital parts expanded; *k*, the fixed outer sheath; *f*, the clasps; *g*, a pale membranous sheath, upon which the *præputium* (*h*) plays as on the finger of a glove, and *i* the fleshy, elastic penis, armed with retrorse hairs, and capable of extending to nearly one-fourth of an inch, *j*, showing the end still more fully enlarged. With this exposition of details not easily observed or generally understood, the act of fecundation is no longer a mystery.

Experiments which I have recently made lead me to believe that parthenogenesis, though not improbable, seldom takes place in this species. In some sixty instances where I excluded the males, the females either worked out of their follicles and dropped to the ground without ovipositing, or else died and dried up in the ends of the same, likewise without laying. I have found the same to hold true in those exceptional cases (four have already come under my notice) where, in a state of nature outdoors, the larva had

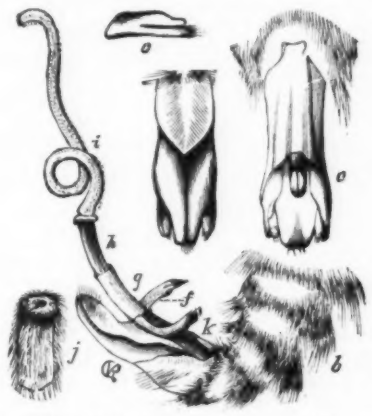


FIG. 3.—BAGWORM: *b*, the end of male abdomen from the side, showing genitalia extended; *c*, the same from beneath in repose.

undergone its transformations, head upward. In every instance the poor female had worked out of the puparium, and butted against the closed end of the follicle, perishing finally without laying, because the male could not reach her.

The impregnated female that has laid her eggs always works out of her follicle when her task is completed, and drops to the ground exhausted; but she may at once be distinguished from those which perish without ovipositing, by her shrunken, eggless body.

Regarding the fawn colored down which the female intermingles with her eggs, the statement made in my former article is inaccurate. More critical study shows that it is, as Harris states, the silky hair rubbed off her body. If examined while yet in her puparium, and just before she would naturally issue therefrom, each ring of the body of the female is seen to be more or less clothed with this silky material; while the eggs are perfectly free from it until they are laid. Under the microscope this covering is seen to consist of the most delicate fibers, many times finer than ordinary silk, and it is so easily detached that most of it rubs off and remains in the puparium, on the partial issuance therefrom by the female.

A DOG LOSES HIS VOICE.

DARWIN asserts that the barking of dogs is largely a result of domestication. As a servant of speaking man the dog has learned to "speak" also. The London *Examiner* notes an occurrence which shows that the dog may lose his voice by a reversal of the common influence.

A deaf and dumb lady living in a German city had as companion a younger woman, who was also deaf and dumb. They lived in a small set of rooms opening on the public corridor of the house. Somebody gave the elder lady a little dog as a present. For some time, whenever anybody rang the bell at the door, the dog barked to call the attention of his mistress. The dog soon discovered, however, that neither the bell nor the barking made any impression on the women, and he took to the practice of merely pulling one of them by the dress with his teeth, in order to explain that some one was at the door. Gradually the dog ceased to bark altogether, and for more than seven years before his death he remained as mute as his two "companions." When expression by sound was useless, it fell with him into absolute disuse.

CONTAGIOUS PNEUMONIA.

EPIDEMICS of pneumonia have been described from time to time, chiefly on the Continent, and an account of recent outbreaks, having almost an epidemic form, which occurred at Moringen, in Hanover, has been given by Dr. Kühn. In this place he has more than once observed pneumonia to have an epidemic character, and on one occasion it broke out in the jail, when overfilled. All other conditions being favorable—position, soil, drainage, ventilation, drinking water, clothing, and food—the cause of the outbreak appeared to be the impurity of the air of the cells. The individual cases presented the aspect of a well-marked infectious disease, with much prostration, a considerable enlargement of the spleen, albuminuria, and, in two-thirds of the cases, diarrhea.

It is notable that the disease did not begin, as in ordinary acute pneumonia, with a sudden onset and rigor, but was ushered in by four or eight days of prodromal symptoms. The pyrexia came on usually without an initial rigor, and ran a severe course. The pneumonic consolidation was recognizable usually on the third or fourth day of the fever, was frequently seated in the upper lobes, and exhibited a marked tendency to migrate. Often it was accompanied by inflammation of the serous membranes, pleurisy was almost constant, in one-fourth of the cases there was pericarditis, and of forty-five cases well-marked meningitis was present in five. Angina and stomatitis were not unfrequent accompaniments. The temperature sometimes attained a height of 107°, and began to remit on the fifth to the seventh day. Post-mortem examination showed fatty degeneration of the heart, acute swelling of the spleen to three times the normal size, and a parenchymatous nephritis. Frequently the intestinal follicles were swollen. The disease was distinctly infectious.

The attendants of the institution were affected, and the disease was conveyed by visitors to other persons who did not come near the prison or its inmates. In one epidemic Kühn observed eighty-three, and in another seventy, cases. In each epidemic abortive attacks of the disease were also observed. He urges that this form of pneumonia must be distinguished from the genuine croupous pneumonia, and that its character approximates it to typhoid disease, and he suggests that possibly it may be due to the same poison as typhoid, modified by some unknown conditions—a sport, as Dr. Roberts would put it, of the typhoid germ.—*Lancet.*

[Continued from SUPPLEMENT No. 150, page 2392.]

ON SYSTEMATIC EXERCISES: THEIR VALUE IN THE PREVENTION OF DISEASE.

By EDWARD T. TIBBITS, M.D., London, Eng., Physician to the Bradford Infirmary and the Bradford Fever Hospital.

IT is generally supposed that the brain is the organ of the mind. But the mental operations carried on within the skull could not take place independently of the senses. Hence mind appears to involve not only the centers, but the peripheral portions of the nervous system. We might even say that it exists in the muscles, and to a certain extent in every organ of the body; that, in fact, it includes body—that the latter is a part of mind. In all probability, there are in each one of us certain innate physical, and therefore mental peculiarities, which may be truthfully expressed by the word "tendency." It is well known how these tendencies may be kept in check, altered in their course, or almost extinguished by judicious moral and religious education, and various external influences, social or otherwise. There is nothing irrational in supposing that these tendencies are dependent upon various physical conditions of nerve cells and fibers, peculiar to feeling, thought, and volition; and that they are probably influenced to some extent by the state of muscles, glands, and viscera. In any case, it does not appear unphilosophical to make a division of cells, fibers, and other tissues concerned, into three groups, corresponding to the threefold constitution of the mind: (1) affective; (2) ideational; (3) volitional. From our knowledge of other parts of the body, we should expect, by a constant and judicious exercise of the parts involved in each group, increase of cells and fibers in number or size, or both; probably some alteration of chemical composition; and, lastly, more decided and efficient action. Feeling would be intensified, thought refined and elevated, and volition strengthened. Conversely, we should argue that, if the cells and fibers in any one group were allowed to remain in a state of inactivity or sluggish action unduly prolonged, it must be followed by obtuse feelings, intellectual degradation, and an enfeebled, vacillating will; and this appears to be strictly in accordance with our experience.

Use or exercise then begets growth, development, and power; disuse, or the want of exercise, wasting, degeneration, weakness, and in many instances, extinction. To quote a few examples:

1. Regular physical exercise, short of over-fatigue, promotes growth, elasticity of muscular fiber, facility of movement, while an undue prolongation of inactivity ends in atrophy.

2. In double organs destruction or inefficiency of one throws more work on the other, and as a consequence enlargement ensues.

3. The loss of one sense increases the acuteness of the remaining ones, because they are exercised more frequently and with greater attention and accuracy; and, further, we know that each of the special senses may become educated and developed by exercise to an extent which is almost marvelous. Is there the same physical condition in the educated and uneducated sense? I think not.

4. The complicated movements of the acrobat are executed with the greatest difficulty at first, even when commenced, as they usually are, during childhood. By degrees, after tremendous repetition, they become more elegant and perfect, and at last almost automatic. And so with the accomplished pianist and violinist, who certainly can execute many airs with scarcely any mental effort. The first few notes serve to recall the association of sound, touch, and succession of movements, and the remainder of the piece is completed automatically.

5. Some authorities contend that memory implies growth of new cells and fibers, and possibly further development of old ones. At any rate memory is vastly improved by exercise, and almost lost if not properly cared for and used.

6. The same effect of exercise, or the want of it, is quite as apparent in the case of the emotions.

In every human being there is, hypothetically at any rate, a certain quantity or charge of nervous energy, which must eventually be expended in some way or other. There are three directions in which it may travel; the affective, the ideational, and the volitional—all three; or it may chiefly and morbidly be expended in one direction only. Now it is possible to direct this nervous energy into one of these three channels, and in some measure to regulate its force. And not only so, but energy flowing in one direction—say the affective—may, especially in early life, during the period of growth and development, be checked to a considerable extent, and diverted into either the ideational or the volitional channel, one or both. The following may be quoted as a few arguments in favor of this view:

(*a*) When a little child receives an injury, it is wonderful how a really sharp blow may be rendered comparatively imperceptible by directing its attention suddenly to a bright light or color, a loud or musical sound, or something which acts for the time being with great intensity on some of the fibers engaged in one of the special senses.

(*b*) The powerful stimulation of one set of fibers acts occasionally in direct antagonism to that portion of the nervous system involved in some of the emotions. Mark the effect of music through the medium of the auditory nerve. Does it not calm the passionate, encourage the timid, and soothe the distressed? In these instances the combination of fibers etc., concerned in the emotions of anger, fear, and grief, become passive, as it were, before the intense stimulation of the nerve of hearing.

(*c*) Are not hiccough and sneezing readily checked by the sudden stimulation of some other portion of the nervous system?

(*d*) Pain—positive pain—vanishes in a remarkable manner when attention is riveted on something else. The disagreeable sensation of cold is sometimes scarcely perceived (as I have myself frequently experienced) when one of the special senses is powerfully stimulated, or the mind deeply engaged in thought.

(*e*) Dr. Broadbent, in his interesting lecture on the Construction of the Theory of the Nervous System, argues that the inordinate action of the lower limbs in locomotor ataxy is due to *concentration of energy* in the nerve nuclei of the lumbar enlargement. He considers that motor impulses passing down the antero-lateral columns are in the normal state distributed to many segments of the cord by the coordinating fibers in the white portion of the posterior columns; but, in consequence of disease of the latter, they cease to perform their functions, and the whole force of motor impulse is expended on the nerve nuclei in the lumbar region. The removal of energy by disease from certain portions of the nervous system increases the power of that remaining intact. Hence the activity of healthy nervous tissue appears in certain instances to be increased when some portions are rendered inactive by disease.

(*f*) Last year, among my out-patients at the Bradford Infirmary, I met with two epileptics who were sometimes enabled to ward off an approaching attack, in the one case by seizing the right wrist with the left hand and holding it down very firmly on the right thigh for a short time, in the other by starting up and running quickly 200 or 300 yards.

(*g*) It is said that an ague fit may be deferred by putting back the clock unknown to the patient.

It appears, then, that nervous energy may be transferred from one portion of the system to another, or it may be concentrated in a particular direction; and, further, that a morbid activity in one portion may be diminished by arousing the dormant energy in another. Therefore, I believe that systematic exercises which involve the volitional portion of the system may be expected to produce an increase of all parts which contribute to the origin, maintenance, and continuance of healthy volitional action; and, as a final result, bearing in mind the gradual building up of the will on the purposeless movements of the infant, we ought to have an interest in the power of the will. Is it possible that growth and development of muscle can have any conceivable connection with a high moral tone? I believe it is, and for the following reasons:

1. Emotion is usually accompanied by certain outward physical manifestations which are to some extent under the control of the will. Coexistent with the mental state certain glandular and other effects are produced. Now, by exercising an inhibitory power over the muscles it is possible to stifle, or at any rate reduce, the violence of the emotion. By systematic exercises the muscles develop, become more powerful, act more readily, and thus lead to a more efficient control of the feelings. At the command of the will the muscles are kept at rest, glandular and other effects are less marked, and, finally, the emotion gradually dies away.

2. Mark the attitude of an individual who expresses a determination to carry out his plans. He clinches his fist, stamps his foot, and says with emphasis "I will" simultaneously, and his muscles generally are in a state of contraction. And is there not a muscular element in that unflinching resolution to bear severe pain without outward manifestation?

3. Muscular exercise produces power and a readiness to act in obedience to a wish which must of necessity engender confidence. This confidence in the ability to act is a mental process springing out of physical strength. What cannot be accomplished by careful preparation? Note the admirable swim of Webb and the prolonged walk of Weston, both feats of prodigious and unexampled endurance. In each case there was undoubtedly an intense feeling of fatigue, amounting to severe pain, and yet they were enabled by a powerful exercise of the will, greatly aided by, if not actually arising out of muscular development, to bring their labors to a wonderfully successful termination. May not any of the emotions be fitly compared with the state of fatigue? And is it not, moreover, true that they are all more or less under the control of the will?

4. But, further, systematic exercises assist in the control of the feelings and appetites—(*a*) *By Exhaustion.* It is clear that by expending a certain amount of nervous energy in a definite direction, which must be given off in some way or other, the tendency to take any other direction is greatly diminished. (*b*) *By habit.* By degrees exercises become so much a part of the individual that they are performed as a matter of course. Early rising, for instance, is usually an act for many years of self-denial, but by frequent repetition the effort is reduced to a minimum. Is it not reasonable to suppose that an active vigorous condition of muscle is of material assistance not only in taking the final leap, but in forming the resolution to do so? After a time, indeed, may there not be a certain amount of automatic action about it?

5. Of course, it is not by any means a universal fact, but it is a matter of observation that the woman is more emotional than the man. Has muscular development any share in the production of this difference?

6. Almost every practitioner knows that an individual who has been suffering from acute disease has not that control of the feelings which is natural to him. Has the wasting of muscle anything to do with this?

Now, if excessive selfish indulgence has the morbific influence which I have ascribed to it, then it follows that an increased power of the will, and a more constant and regular exercise of it, must, of necessity, prevent much disease. It has been shown that some of the more important physical phenomena accompanying states of feeling are directly and powerfully, I do not say solely, influenced by the will; in other words, the muscular movements at any rate may be checked, or almost extinguished, by volitional control. This control is strengthened, facilitated, and made more efficient by systematic physical exercises. Following the same line of argument, I believe that mental exercises of a suitable kind are second only to physical exercises in importance. If this be so, there remains this question, which is one well worthy of the serious consideration, not only of each individual member of the medical profession, but of every reformer, statesman, and philanthropist. In what manner, when, and how long should these systematic exercises be employed? Without attempting to give even a sketch of a complete answer, I would merely venture to mention one or two points which have occurred to me:

1. That systematic physical exercises should take a very prominent place in the training of our youth, irrespective of rank, in both sexes, and they should form a very much larger share of the instruction given in our board schools than they do at the present time.

2. That during the first ten years of life, systematic mental exercises over and above reading and writing should be of a moral nature. The beauties and advantages of truthfulness, temperance, and honesty should be impressed upon the youthful mind, and contrasted in their results with the hideousness and degradation of dishonesty, intemperance and deceit. Without a shadow of a doubt, it is far more important during the first decade of human life to point out the difference between right and wrong, and see that there is a decided and proper appreciation of it, than to crowd the brain with facts and figures, or with anything else. It must not be forgotten that physical exercises lose much of their value apart from mental and moral ones, as far as control of the will is concerned, as may be witnessed over and over again in the persons of professional athletes, prize-fighters, and soldiers. The physique of a man may be ever so good, and he may have great volitional control, but it is of little use unless he knows when to exercise that control. As well might you expect a vessel classed A 1, thoroughly well furnished with efficient machinery, able seamen, and judicious officers, but without helm, compass, or chart, to make a safe and rapid voyage to the antipodes.

3. That when children become capable of understanding them, a few simple facts relative to the laws of health should be presented to their minds. This would naturally include the results of non-observance of those laws, and thus the necessity of self-control would be forced upon their attention.

In conclusion, however unpalatable and nauseous the idea, disease appears to be in many instances an evil of our own creation; and I cannot help thinking that the allotted term of threescore years and ten might be much more frequently attained, without of necessity entailing a life of rigid asceticism, by a constant persevering habit of self-denial, steadily and firmly maintained by systematic exercises.

A NEW SEARCHER, FOR DETECTING MINUTE FRAGMENTS OF STONE IN THE BLADDER.

By EDMUND ANDREWS, A.M., M.D., Professor of Surgery in Chicago Medical College.

DURING a former clinic I showed you this instrument, which I have devised for detecting very minute fragments of stone in the bladder. At that time I applied the instrument in your presence, and gave you an opportunity to observe the loud sound it transmitted to the ear when the stone was touched. The calculi then discovered were, however, fully of average size, so that they gave you no opportunity to test the new searcher upon minute particles.

I now present you a patient whose calculus is extremely small, so much so that it gives no jar to the finger nor sound to the ear when touched by an ordinary steel searcher.

Some weeks ago the patient had symptoms of the descent

of a stone through the left ureter, and ever since has shown some very slight symptoms, as though the little object was still in the bladder. We will now insert the new instrument; but first let me recall to your memory its simple structure. It consists of a thin metallic tube, like a catheter, only it is closed at the curved end, having no fenestrum. The curve is rather abrupt, and the bend short, as in the ordinary steel searcher. The straight extremity is open, and is inserted into a small rubber tube two feet in length, and terminating in an ear-piece, such as is used by aural surgeons in listening to the tympanum. I now oil the metallic part, and inserting it into the bladder, feel for the stone, in the ordinary manner, omitting, for the present, to use the ear-piece. There is not the faintest jar or sound to be felt or heard. Now see what a difference the auscultation tube will make. I take the ear-piece and place it in my auditory meatus, and again search for the stone. I now hear with perfect distinctness the delicate "click" of some hard particle in the bladder, so small that it conveys no sensation to the fingers holding the instrument. This shows the extreme delicacy of this species of auscultation.

Withdrawing the searcher, let us insert this small lithotrite and endeavor to seize the stone. Opening the blades and turning the short beak backward, I close them gently. There is evidently some hard object in its grasp, for the blades do not quite close. I now draw it gently out and present it for your inspection. You see we have a little urinary calculus, scarcely larger than a grain of wheat, which would never have been detected by the ordinary steel searcher. Inserting the instrument again, and feeling carefully in every direction, I find no more pieces; still I will renew the search daily for a few days, when, if no more calculi are found, I shall pronounce the patient cured.

Soon after I showed you this instrument for the first time, some weeks ago, Sir Henry Thomson, of London, brought before a learned society in that city a rather complicated apparatus having precisely the same object as this, but very different in its construction. His contrivance is very ingenious and interesting. It consists of an ordinary steel searcher, to which is attached a galvanic battery, and the new carbon electric apparatus, called the microphone. The microphone, as you know, magnifies sounds, so that the touch of the sound on a very small piece of calculus is rendered distinctly audible when the sound reaches the microphone.

I doubt not that Sir Henry's apparatus works well, so far as detecting the stone is concerned, but the necessity of attaching to it a regular battery and a microphone is a serious impediment to its convenience and portability. I think that the delicacy of perceptions obtained by my instrument must be equal to that of Sir Henry's, while in lightness and simplicity it is much superior.

Probably the most important application of the new searcher will be, in cases of lithotrity, to search the bladder for the last minute fragments of the stone, and to determine when they are all removed. It is always a matter of great anxiety with the surgeon to determine this point. It is also capable, if modified in form, of discovering hard foreign bodies in the œsophagus, the stomach, the nostrils, the rectum, and in fistulas and deep wounds, as well as in the trachea and bronchi, during tracheotomy. It can also be attached to probes, to detect fragments of necrosed bone in the bottoms of deep sinuses.

Another advantage is, that where fistulas are crooked, or bladders are obstructed by overhanging prostatic lobes, so as to defy the entrance of rigid instruments, flexible tubes with metallic tips can be used, which will slip around the curves and obstructions, and send audible reports to the surgeon's ear, of sequestra, foreign bodies, or calculi, which are inaccessible to all ordinary probes and sounds.—*Med. and Surg. Reporter.*

BILIOUS DISEASES—WHAT ARE THEY, AND WHY SO CALLED?*

By I. H. NOWLIN, M.D., of Little Rock, Arkansas.

THE word "bilious" is thus defined by Dunglison, the great American and English authority: "That which relates to bile, or is produced by bile. An epithet given to certain constitutions and diseases which are believed to be the effect of superabundance of the biliary secretion; as bilious temperament, bilious symptoms, bilious fever, etc.; *but often used without any definite idea as regards the bile being attached to it*" (italics mine). "Biliousness is the state of being bilious."

Bennett, in his work on physiology, uses the following language: "If more non-nitrogenized food be taken than can be got rid of by the lungs, in the form of carbonic acid, the liver pours a greater quantity of bile into the duodenum, causing the symptoms known as bilious." By others (as Dr. G. B. Wood), any departure from the normal secretion as to quantity or quality, whether a greater or less amount or whatever the change in character or appearance, is called a *bilious attack*. With such latitude embraced in the use of the word, it is no matter of surprise, however much the fact may be regretted, that we have no certain means of arriving at its meaning when used, unless it is explained. Again, there are those (and their name is "legion") in our profession, not a few, and among the masses, perhaps nine-tenths, who, upon every occasion of indisposition, however trifling, see nothing but a "bilious attack," recognizing no organ in the economy but the liver, and charging to its account every "ache and pain;" the effects of every act of imprudence, whether of eating, drinking, exposure, over work, or of indolence (the root of many evils). And it is a humiliating thought, one painful to contemplate, that this state of ignorance among the people throughout the land is the legitimate result of the careless expressions and indiscriminate practice of many of our better informed physicians, as well as of the "inexorable law of cause and effect" attending upon and following the teachings and practices of the ignorant and unprincipled among them. This is the foundation of the universal idea of "liver diseases and bilious attacks." And hence it is, that all civilized (?) lands are, and have been, for years, inundated by "liver pills," "liver correctors," "liver stimulants," "liver restoratives," "liver tonics," "liver regulators," etc. (*ad nauseam*), numerous as the "frogs or lice of Egypt," and, without doubt, much more detrimental.

To exemplify this superlative ignorance, I will mention briefly one or two recent cases in my own practice, as representative ones. I was invited to see a Mr. N., a printer, of some intelligence on general subjects, some twenty-five years of age, laboring under remittent fever. The attack was but a mild one, requiring only a few days in the house, with appropriate remedies, to "break it up." He, however, was quite uneasy about his liver, saying it was "painful," etc. On being asked for the location of the pain, he placed his finger just above the crest of the left ileum, saying, "*It is right there.*"

Within the last forty-eight hours, a merchant of our city, nearly fifty years old, called at my office, looking very well, but rather serious, as if in trouble. After sitting a short time, he very gravely asked "if I had ever known a person discharge a portion of his liver through his bowels." I replied, "Certainly not; that would be an impossibility." He rejoined that "he had suffered many years from liver disease, by occasional spells;" that he was satisfied it was so, "because his physician had so told him." I could learn nothing from his present appearance and condition, nor from his history, to indicate that he had ever had anything more than transient spells of indigestion, with general sluggishness of the chylopoetic viscera. Finding that I was entirely skeptical as to his having, or ever having had, liver disease, he produced, carefully wrapped in paper, the *piece of his liver* (as he supposed), discharged per anum the previous night. Upon examination, I made it out the skin of a muscadine (the fruit of the vitis vulpina), or some other thick, tough-skinned grape (!), which seemed to have been retained for some days, and only discharged after taking a dose of "Blank's pills." The result of the examination was so satisfactory, that he bade me "good by," without insisting on a prescription. What a fine chance for "a good fat bill" some *liver* doctor missed, by not getting this case!

As before remarked, ignorance and cupidity are not alone responsible for the erroneous popular views, so extensive and detrimental. The careless expressions, and more or less routine practice—together with their entire neglect to give other and better instruction—of many of our well qualified and judicious practitioners, have contributed largely to the production of the errors so prevalent. By way of illustration I will mention a single representative case: Dr. H. is a well educated and highly qualified physician; a practitioner of twenty or more years. After prosecuting successfully his studies in America, he visited Europe, and continued them in both London and Paris. Returning, about 1866 or 1867, he settled in the "City of Brotherly Love," and there remained, practicing his profession, for a number of years. Some fifteen years ago he came South, and our lots were cast together in the same city, where our intercourse was always (at least to one of us) very pleasant. Standing together, on one occasion, in a drug store, some person asked, "Doctor, whom are you going to see just now?" The doctor replied, "Colonel C." Knowing that Colonel C. had but recently gotten up from a partial attack of paralysis, I said: "Doctor, has the colonel a renewed attack of paralysis?" "Oh no," he replied, "he has only a *bilious* attack." I rejoined, "Doctor, please excuse me; I do not understand what you mean by 'bilious attack;' such language does not belong to my vocabulary; please describe to me Colonel C.'s pathological condition." The doctor looked at me, and with a pleasant smile, as he turned away to attend to something else, only replied, "It is a very convenient expression, sir." And so the conversation ended.

Such *convenient expressions*, vague, and almost meaningless, though they are, uttered carelessly and without any thought of evil resulting, by physicians of high standing in the profession, are seized upon both by the ignorant masses and mercenary quacks; by the former as interpretations of their own (real or imaginary) afflictions; and by the latter (whose legitimate place should be the House of Correction) as *authority* for their own diagnoses and prescriptions. Such evils, thus beginning without design, become interminable. Long ago, from a knowledge of the facts and considerations mentioned above, the writer determined to ignore all so-called "bilious troubles," and to make an effort to establish among his patrons views more consistent with facts, as well as more conducive to their own comfort. A man or woman once convinced of the presence of a liver trouble, or "bilious attack," is ever afterwards a prey to evil forebodings and imaginary biliousness, inflammations, or abscesses of the liver, etc., in nineteen cases out of twenty without a particle of foundation for such belief and suffering, but that some doctor said, years ago, "your liver is diseased." Since adopting his present plan, the writer has found no difficulty in designating diseases by names much more expressive of their real pathological status. And as to success, it has been all that could have been reasonably expected or even desired.

In all cases of general disease, especially when acute, functional disturbances are present in all the organs of secretion and excretion—the skin, lungs, kidneys, and liver. These are organs of vital importance in the economy, some of them altogether depuratory, while others are also assimilative and renewing in their offices, so that not one of them can be excused from duty, even for a very short time, without imminent peril to life, and inevitable dissolution, if not restored speedily. Why, then, should the liver be made "the scapegoat" "to bear away the sins" (so to speak) of every other organ of the system? Why shall we say, bilious fever, bilious pneumonia, bilious pleurisy, bilious colic, bilious headache, bilious erysipelas, etc., when, in numerous instances, the liver is the least offending organ of the whole? Why, at the present day, if a man, by excessive eating and drinking (surfeiting), so shocks and paralyzes the stomach that for a time it ceases to act, apparently conscious of its inability to perform the labor imposed upon it in the ordinary way, by the liver, is that organ at once censured? And when, after a longer or shorter interval, a degree of reaction is established, the stomach becomes disgusted, as evinced by the intolerable nausea, which soon culminates in active and continued vomiting, till not only the whole of the offending mass is disgorged, but a copious discharge of bile occurs, as a sequel, then, indeed, is the diagnosis confirmed! "See how immensely bilious he was; I thought that was just what was the matter," is heard from the lips of the bystanders, and very likely from the attending physician also! The indication is then unmistakable; "a corrective of the biliary secretion is the very thing." The universal blue pill, or the coextensive hydrarg. chlor. mitis, comes at once into requisition, *notwithstanding the positive evidence present, that the liver is performing its functions "all right."*

Excepting the writer's own efforts to correct opinions and practice so false and detrimental, he has certainly heard none, nor does he recollect to have seen any, from any source. And, as a personal friend to the liver, he now, here, enters his emphatic protest against such slanderous accusations, made (occasionally from inadvertence, by good men) and propagated by unprincipled, mercenary quacks (and their poor, unfortunate dupes), "who do not know" (as that model journal, the *American Agriculturist*, said, in a late number, writing upon the same subject), "whether their livers are in their stomachs, or their stomachs are in their livers." And, as to a knowledge of its functions, the daily amount and uses of its secretions, they have little more information (though not a tithe of their modesty) than certain long eared animals, that, to their credit be it said, confine their acts within the sphere of their knowledge, thus showing themselves the more rational, and, may I not say, moral (?) of the two classes. To inform such vampires that bilious matter is always thrown up by long continued vomiting, if the liver is in healthy condition, whatever may be the cause of the emesis, would be only "casting pearls before swine;" they would only "turn again (when absent) and rend you," "fearing lest their craft be endangered."

That the liver is often, more or less, functionally at fault, generally from excessive or improper ingesta, overcrowding the portal system, there cannot be a reasonable doubt. And just as often will the skin and kidneys exhibit like disturbances. The same is also often true of the lungs. Why, then, refer the whole trouble to the liver, and say that it is diseased, and that the case is a "bilious attack?" prescribe mercury in some form, under the impression that the liver needs urging to duty, and that the prescribed remedy will be sure to do it? when, at the same time, absolutely nothing is wanting but rest, abstinence from food, and, it may be, a gentle aperient, giving the portal vessels and liver a little time to "unload." Such cases are truly spells of indigestion, and should so be called. The entire blame should rest upon, not the liver nor the stomach, but the patient, who should be starved till he is taught to treat his digestive apparatus with more consideration.

It is unquestionably true, also, that the liver is occasionally diseased organically, seriously, and even fatally. During an experience of more than thirty-six years, one such case for every two years of that time, I feel warranted in affirming, would limit the number that has come within my observation (bating possible errors in diagnosis). Indeed my recollection cannot now furnish that number. I have seen only one case of malignant tumor of that organ. My diagnosis was confirmed in Richmond, Va., by Dr. B., and in Philadelphia, by one or more physicians. The patient was in Richmond some few months after my opinion was given in Salem, Va. I have not met with more than half a dozen cases of acute hepatitis, all recovering but one. Not more than four cases of abscess of the liver have come under my knowledge; all recovered, the discharges occurring through the intestinal tube, except one, which took place through the abdominal wall, by adhesion and absorption. The other organic diseases of the liver I have seen have been in old persons, indurations, enlargements, degenerations, etc., producing effusions into the cellular tissues (anasarca), in cavities, hydrothorax and ascites, and thus terminating life. My own opinion of the liver is, that it is a very hardy, durable organ, only wanting fair usage to reach good old age.

* *Medical and Surgical Reporter.*

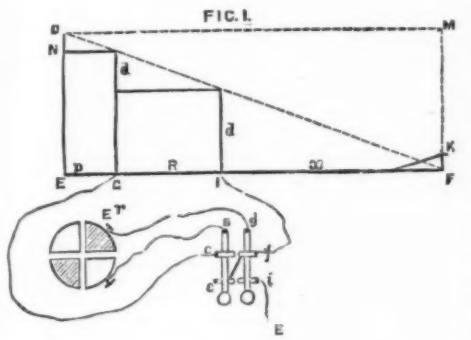
If an apology is due to the readers of the REPORTER for the infliction of this paper upon them, the only one the writer has to offer is the earnest desire he feels for the correction of the erroneous and highly detrimental opinions of the masses concerning the liver, its functions and diseases, which, to day, constitute, in his opinion, one of the greatest curses affecting Christendom.

Who will aid in the effort?

A NEW METHOD FOR DETERMINING THE CURRENT ELEMENTS OF A VOLTAIC CIRCUIT.

A PLAN for quickly determining all those values which are known as the "current elements" has long been a desideratum. Hitherto the connections have had to be altered, and even altogether different apparatus employed, in carrying out the various tests. The desideratum in question has now been supplied by a new series of tests—including the determination of the intensity of the current, the electromotive force of the source, the external resistance of the circuit, the internal resistance of the battery, and, finally, the degree to which the latter has become "polarized"—which has been devised by Mr. Desmond G. Fitz-Gerald, and which involves a key of novel construction, to which the name of "shifting contact key" has been applied, because it is so arranged as to transfer the contacts, by its depression, from one part of the circuit to another. The electrometer is the instrument of precision used in the tests.* The theory of this system is illustrated by the diagram, Fig. 1. The fall of potential taking place over any given resistance in a circuit is, *cæteris paribus*, proportional to the resistance; therefore, if we know what is the fall over a given resistance, we can easily calculate the resistance proportional to any other fall, indicated by a suitable instrument. The application of this principle, by means of which the external resistance and internal or battery resistance in this case are

FIG. 1.



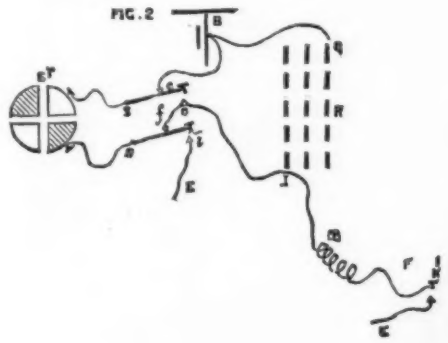
measured, is not in itself novel; the novelty in the present system of testing consisting in the convenient arrangement of a number of tests, so to speak, into a small compass.

Bearing in mind that the distribution of tensions in a circuit, after the normal statical conditions have been obtained, is represented, in the case of an insulated circuit, by two triangles, and, in the case of a circuit where the negative pole of the source is connected to earth, by a single triangle of the form D, E, F, Fig. 1, let E F represent the sum of the resistance in a circuit, and E D the electro-motive force acting in the circuit; then E G = ρ will be the internal resistance of the source. G I = R may be taken as a known, or *unplugged* resistance, and I F = x as an unknown wire resistance in the circuit. The positions in the circuit of the elements of a single couple are indicated at E and G, the positive element at E being connected to earth, so that E D represents the potential of the layer of fluid in immediate contact with this element. It must also be borne in mind that, before the key, k^1, is depressed, the tension in the circuit will be everywhere the same, and is represented by the parallelogram, E, D, M, F. The key, k^1, is inserted at some point in the circuit, so that the electro-motive force, E D, or what we call deflection, D, may be obtained while the circuit is broken.

We will now proceed to describe the different methods of obtaining the several deflections, etc.:

Test 1. Maximum potential or electro-motive force = deflection, D. It will be seen from Fig. 1, in which E represents the positive element of the source, connected to earth, that on depressing the right hand spring, s^1, one pair of quadrants of the electrometer, E^1, is connected to earth, and as E is also to earth, the quadrants are virtually connected to E; the other pair of quadrants being connected through spring, s, with G. Now the key, k^1, being up, we obtain a deflection, D, which is the maximum potential or electro-motive force of the source, E; in fact we obtain E D. But D is only a certain number of degrees on a scale, and we require to know the electro-motive force in volts, therefore we must know the number of degrees that a standard of a known value in volts will give on the same scale. Suppose we have decided to use Mr. Latimer Clark's standard element, having an electro-motive force = 1·457 volt; suppose also that this

FIG. 2.



* A condenser and galvanometer may be used in lieu of the electrometer; the "throw" of the needle being observed when the condenser is charged or discharged.

element gives a number of degrees = D^1, then we have the proportion—

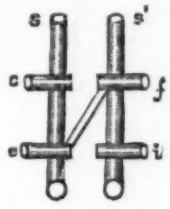
$$D^1 : 1{\cdot}457 : : D : E,$$

from which proportion the required electro-motive force is

$$E = 1{\cdot}457 \frac{D}{D^1} \text{ volts.}$$

Test 2. To obtain the unknown wire resistance, x.—In this test, k^1 must be depressed so as to close the circuit, when the potential will fall proportionately to the different resistances in the circuit, as shown by the line, D F. Now when k^1 is

FIG. 3.



depressed and the connections are as in Fig. 1, we have indicated on the electrometer the deflection corresponding to the fall of potential over R, the known resistance; let us call this deflection d. Now all that has to be done to obtain x is to depress s and s^1 together, whereby the electrometer contacts are transferred from G and I to I and earth, and, F being to earth, the contacts are really transferred to I and F, and we now have, indicated on the electrometer, the deflection corresponding to the fall of potential over x. This deflection let us call d^1; now as we know d and R and d^1, it will be easy to calculate x from the very evident proportion—

$$d : R : : d^1 : x;$$

thus

$$x = R\frac{d^1}{d}.$$

We have now obtained the electro-motive force and x, we have still to obtain ρ; and when this is obtained we have all the materials for our equation for (1) the intensity of the current, viz., $I = \frac{E}{R + \rho}$.

Test 3. To obtain the internal resistance (ρ) of the battery.—We can get no deflection to represent the fall of potential over ρ, because the only way of obtaining it directly would be by putting a negative as near as possible to the zinc in the fluid—in fact, by making the resistance of the battery *nil*. We must, therefore, obtain it indirectly. It will be seen by Fig. 1 that D N is the actual fall of potential over ρ, and it will also be seen that the value for D N may be arrived at by subtracting d and d^1 from D, thus $D - d - d^1 = D\,N$. Now if we could arrive at this result directly this would represent the deflection corresponding to the fall of potential over ρ; and ρ is found, from the proportion $d : R : : D - d - d^1 : \rho$, to be

$$\rho = R\frac{D - d - d^1}{d}.$$

A point which is now recognized as of very great importance is to obtain the values from which the internal resistance may be calculated without circuiting the battery for a sufficient space of time to allow of any "polarization" taking place. It is frequently desirable, in fact, that the battery should not be circuited for a period of time exceeding one second before obtaining the electrostatic charges on which these values depend. The plan recommended in order to obtain the real resistance of the battery with the greatest accuracy is, first, to depress k^1; secondly, instantly to bring the springs, s and s^1, between the stops; and, thirdly, to release k^1. It is frequently advisable to use a small condenser in combination with the electrometer, its terminals being simply connected respectively to the two sets of quadrants.

We have now all that we require in the equation

$$I = \frac{E}{R + \rho},$$

and, therefore, can calculate the intensity of the current.

To obtain the degree of "polarization" of the battery; calling ε the electro-motive force of the battery when the circuit has been closed any given period of time, it is evident that if the "polarization" be *nil*, $\varepsilon = E$; but if "polarization" has occurred, $E > \varepsilon$, and its exact value as an electrical deflection may be calculated from the proportion—

$$x : d^1 : : \rho + R + x : \varepsilon$$

and

$$\xi = \frac{(\rho + R)d}{x} + d^1$$

and the "polarization" is measured by $E - \xi$.

The construction of the key will be understood in a moment by referring to Fig. 3, from which it will be seen that the key is somewhat similar in appearance to an ordinary reversal key, the difference being that the lower and upper contact pieces, instead of being the same for both springs, are cut through and insulated. There is one other difference, viz., the upper contact piece of the right hand key is connected to the lower contact piece of the left hand key. Fig. 2 is a diagram showing the practical arrangement of the instruments employed in these tests, the lettering being the same as Fig. 1.—*The Engineer.*

THREE EXPERIMENTS WITH TELEPHONES.

By PROFESSOR E. SACHER.

IN order to ascertain what were the feeblest induced currents in the telephone that would be sufficient to produce in the ear distinct sensations of sound, on December 27, 1877, I made the following experiments:

1. I led the closed current-circuit of the telephone, at twenty meters distance, parallel with the wire, well insulated with linen and wax, of an ordinary telegraph apparatus. The signals were given at first by six, and afterward by three Smee's elements ($\frac{1}{10}H_2SO_4$); and they were, through the induced currents in the telephone, so distinctly audible that the message (by the two signals, long and short) could be understood.

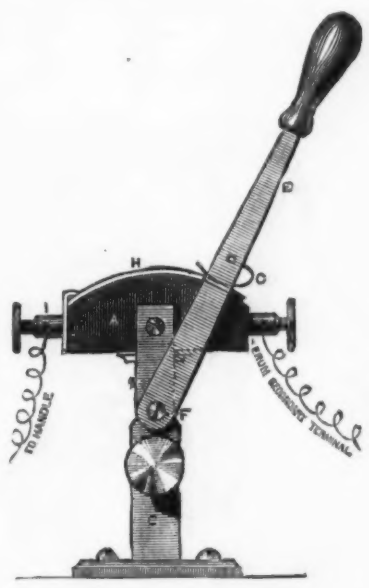
2. I effected a division of the current by uncovering two places in the insulated wire distant from each other twenty meters, and fixing there the ends of a telephone wire of equal strength and 120 meters long. Reckoning, in addition, the thin wires in the interior of the telephone, certainly only a small portion of the current went through it; and yet the rap was perceived with sufficient distinctness for the message this time also to be understood. (Hence it is easy to tap the messages of any open telegraph line if one can learn to read the Morse alphabet by hearing.) Experiment 1 succeeds also when the telegraph wire is connected with the thick, and the telephone wire with the thin wire of a Rhumkorff. If we wish to perceive the signals more distinctly, it is advantageous to appropriate two telephones to the hearing; it is then, moreover, better to close the other ear against external noises.

3. I connected the telephone wire, about forty meters long, with the inner thick wire of an ordinary induction coil, and the wire, 120 meters in length, of a second telephone system, with the outer thin wire. To my great surprise, we could correspond both from the first to the second telephone, and also (indeed apparently still better) in the reverse direction nearly as well as with the connection direct. The words were heard still more distinctly when I inserted in the same manner two induction coils. On the contrary, the experiment was a failure when a Rhumkorff was employed in this way; the sound was too faint.—*Kaiserliche Akademie der Wissenschaften in Wien, math.-naturw. Classe.*

REGULATOR FOR INDUCTION COIL.

By J. E. FLOYD.

A is a block of ebony, of the shape shown, and about ½ an inch thick. It is supported by means of the pillar, B, which fits into a socket, C, secured to the base board of the coil. This socket is situate between the secondary terminals, and is also used to support a small ebonite table for spark experiments, etc. The screw, D, secures either attachment at pleasure. The lever, E, turns on a screw at F, and carries a spring, G, which presses on a strip of soft leather, H, glued over the top of the block. The leather is well impregnated with plumbago, and a small portion of electrical amalgam is rubbed into the surface. The binding screw, I, is in connection with the leather at one end, while the other is connected with the lever support by means of a wire through the



block. The instrument is placed in the secondary circuit, as indicated in the sketch.

When the lever is in the position shown, the current has to pass through the resistance of the prepared leather—the shock is therefore reduced; but when it is turned over on the other side, so that the spring is in contact with the brass at I, the full benefit of the coil is felt. The best proportion of amalgam can be determined by experiment. This regulator is much better adapted than the water regulator for superior coils, as it can be readily attached without interfering with other parts of the coil.—*English Mechanic.*

MICROSCOPY.

New Coloring for Microscopic Tissues.—Prof. Tafani, of Italy, mixes a saturated solution of aniline blue with another of picric acid, in the proportion of four parts of the former to one hundred parts of the latter. With this he obtains a beautiful green for staining microscopic specimens.

On the Supposed Diatoms of the Coal Measures.—Count Castracane has published an account of a process by which he reduced numerous specimens of coals to very minute quantities of coal ash, and has stated that he found in these ashes numerous marine and fresh water diatomaceæ. Prof. Roscoe allowed one of his ablest assistants in his laboratory at Owens College to prepare analyses of a number of coals according to Count Castracane's method. The residual ashes of these preparations were mounted microscopically by Prof. W. C. Williamson, and in no one of them could a trace of a diatom be found. Prof. Williamson, in a paper on the subject read before the British Association, said that "beyond stating the fact, he was wholly unable to account for the discrepancy between his results and those of the Italian observer, but, so far as his present observations go, he found himself compelled to conclude that there is no proof of the existence of either radiolarians or of diatomaceæ in the British carboniferous rocks." Sir Joseph Hooker, Prof. McNab, and Dr. Bayley Balfour expressed views which coincided generally with those of Mr. Williamson.

The Microscopical Study of Ashes of Leaves.—Dr. R. H. Ward, in his paper on this subject read at the Indianapolis Microscopical Congress, said: The unexpected interest excited by a specimen of the ashes of a fragment of rice leaf which he contributed to the Postal Club, led to the presentation of a series of the objects, and an explanation of the method of preparing them. Little attention seems to have been given to the subject lately, and it has been scarcely noticed that other leaves than the silicious ones of the grasses can be so studied. By carefully burning a portion of a dried leaf on platinum foil or thin mica, all the combustible part

can be driven off, and the ash remains unbroken, and exhibit very perfectly many of the microscopic features of the structure. A large series of instructive objects can thus be prepared with little time or labor. Old leaves in autumn are most suitable, and those of trees are generally preferable to those of short lived plants.

Examination of Minute Living Organisms.—Mr. Dudgeon suggests, in the *Science Gossip*, that living microscopical objects might always be seen, if the objective were inclosed in a brass or other metallic tube, having its lower end closed by a piece of thin microscopic glass coming close up but not touching the object glass. With this protection, he says, the end of the microscope may be plunged into a small tank filled with water containing living organisms, and thus the latter may be examined at leisure.

Cleaning Slides and Covers.—Mr. C. E. Hanaman, for cleaning slides as received from dealers, proposes a solution used by photographers for cleaning their negative plates and glass vessels. It consists of a cold saturated solution of bichromate of potash in water, to which about one-eighth of its bulk of strong sulphuric acid is added, the mixture being made in a porcelain or thin glass vessel, as the heat evolved would probably break a bottle, and the vessel being kept outside a window until the mixture is cold; the liquor will then be ready for use. A gross or two of the slides may be cleaned in an incredibly short time by sliding them one by one into a porcelain vessel containing some of this liquid, tilting the vessel about a few moments to cause the liquid to flow through the mass, and then pouring off the liquid and placing the vessel under the stream from an open tap for a few minutes. They are then wiped dry with soft linen cloths, and spread upon a clean sheet of paper, the most perfect surface being placed downward. They are then centered on a self-centering turn table, upon the upper or poorest side, by a dot and a ring of India ink. They may then be placed on their edge in a box or drawer, and kept from contact by interposing small strips of blotting paper at their ends.

The cover glasses are treated with the same cleaning liquid, thoroughly washed with distilled or filtered water, picked out one by one with forceps, and dried by laying each on one end of a soft linen cloth, and gently rubbing first one side and then the other with another part of the cloth. The cloths used for this purpose should be first cleaned by boiling with carbonate of soda, and rinsing in hot filtered or distilled water. If the covers are finally arranged, edge upward, in a box or drawer between strips of thick white blotting paper, they will be kept clean, and the selection of any desired thickness will be greatly facilitated. The strips of blotting paper should be cut two-thirds as wide as the cover, reach from side to side of the box or drawer, and be separated at the ends by squares of the same paper, thus forming a rack.

He recommends that one or two grooved blocks be kept on the working table, in which covers that have been selected for immediate use may be similarly supported on edge, and from which they may be easily taken by the forceps. Such a block is prepared by setting a circular saw so as to cut only three-eighths of an inch deep, and then passing over it several times a block of white wood in such a way as to cut a series of parallel grooves on the side which is to be used as the top of the block. Standing covers in these grooves is a great improvement on the common method of leaning them against the base of the microscope or some other convenient but unsuitable object.

Volvox Globator.—This minute vegetable organism, which has always been a favorite object for observation to microscopists, has quite recently been studied by Prof. Cohn, who has for the first time followed out completely the various stages of reproduction of this singular cryptogam. These will at present be found adequately described in no English work, although so many previous observers have had the plant under their notice. Mr. A. W. Bennett, in a highly interesting illustrated article, has given a complete description of all that is at present known on the subject. This article is printed in the Scientific American Supplement, No. 140, page 2233, and we advise our readers to study it. It is full of interest to every working microscopist.

Four hundred delegates have taken part in the patent congress at Paris.

THE MONTBELIARD BREED.

This portrait represents a cow and calf shown in the 16th cattle class at the Paris Live Stock Show in June last. This class comprised all varieties and breeds not included in the previous classes; and the cow and calf were shown by M. Werlein, of Besançon (Doubs), as specimens of the Montbéliard breed.

THE ALLIGATORS AND THE OX.

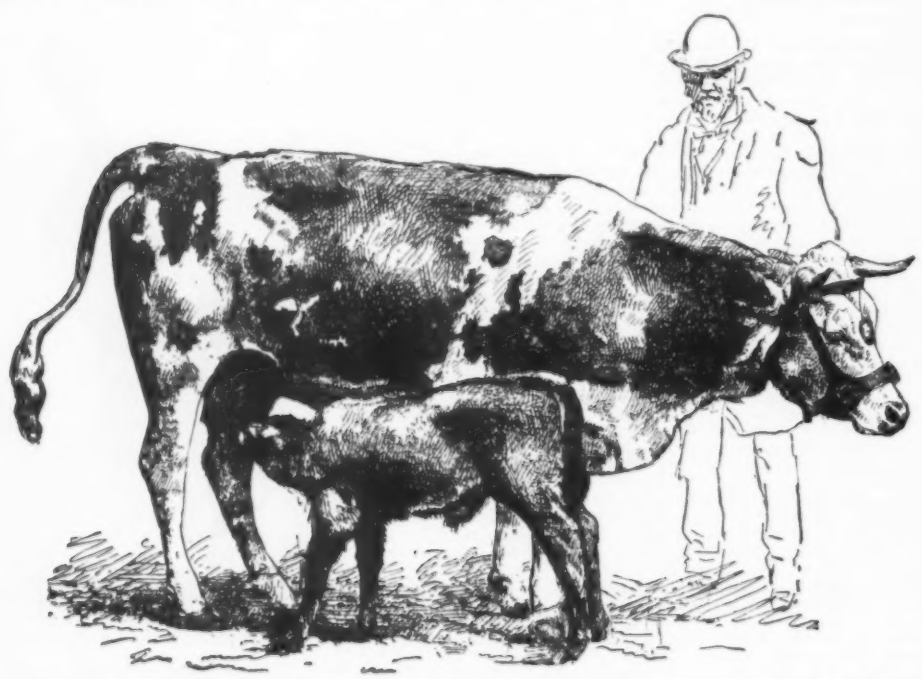
The Tallahassee *Floridian* says: "That the alligator should attack an ox will be surprising news even to those who are thoroughly familiar with the habits of the fresh-water monster. The *Floridian* has been furnished by an eye-witness with the interesting details of the strange encounter at Lake Jackson. The ox went into the lake to drink, and was attacked by the alligator, whose mouth closed on the foreleg of the animal, crushing the bone. The ox started immediately out of the water, dragging the alligator. Enraged with pain, the poor animal reared and plunged wildly, endeavoring to horn his antagonist. Meantime the edge of the lake was black with the snouts of alligators which had smelled the blood that ran from the ox when first struck in the water. Four or five of the monsters crawled out, and, with wide open mouths, started for the attack. Meanwhile the ox loosened the hold of his antagonist, and smarting under the wound, went in with infuriated ardor to the assault of the re-enforced assailant. He caught one of the alligators on his horns and threw him high in the air, the clumsy thing falling heavily to the ground, where it lay stunned. Another was tossed far into the lake. But the gallant ox was, by a false maneuver, again in the water, in which element his activity was impeded, and being surrounded by his foes, one of which caught him by the nose and pulled his head under water, he soon fell a victim by drowning."

CHESTNUT TREE DISEASE.

A peculiar disease has made its appearance in the plantations devoted in Italy to the cultivation of the chestnut (*Castanea sativa*, Mill.), and threatens to inflict an immense damage on those engaged in that branch of agriculture. The Italian government, some time ago, appointed a commission to study the disease and its causes, and to find, if possible, a remedy. The commission consisted of Prof. Giuseppe Gibelli, Director of the Agronomical Station, and Giuseppe Antonielli, a chemist of good reputation. They have now concluded their labors, and handed in their report. The most interesting result attained was undoubtedly the positive certainty that not, as had been suspected, a vegetable or animal parasite was the cause of the disease, but that they had to deal with a simple pathological condition. This is the first time that an epidemic devastating large tracts of cultivated land can only be explained by pathological influences.

The disease has its seat entirely in the roots, especially in the thicker ones, while the thinner ones seem to be less affected. The ligneous part of the root looks brown, loosened, and nearly friable; the peripherical layer next to the epidermis looks darker than in healthy individuals. The epidermis looks as if the whole root had been exposed to a fire and partially burnt. The color varies from a dark jet black to a light brown. The epidermis is very brittle. Trees, the roots of which fit to this description, are not to be saved. The cause of the change is a deficiency of the chemical composition of the root, as is indicated by a lack of potassium and a surplus of iron.

The iron seems to be combined with tannin, and this accounts for the black color. There was also a vast difference found in the percentage of phosphorus in the ashes of sick and those of sound roots; while the quantity of lime found therein was unusually large. Now, it is generally known that chestnut trees prefer a soil containing a large percentage of silicon to one rich in lime. A quantity of 3 per cent of lime in the soil will not allow the healthy development of the tree. We have, therefore, as proximate causes of the disease a lack of potassium and phosphorus, and an excess of iron and lime. The commission have, however, failed to establish a theory by which this abnormal absorption of mineral substances from the soil might be explained. The difficulty, it has been thought, might be removed by supplying to the soil the lacking quantities of potassium and phosphorus, but it seems that so large an amount of iron and lime incapacitates the roots to take up any more potassium and phosphorus than found in the sick roots.



THE PARIS EXHIBITION—M. WERLEIN'S COW AND CALF—MONTBELIARD BREED.

WOOD SMOKE IN GREENHOUSES.

L'Illustration Horticole, in describing the culture of pine-apples in the island of St. Michael, for the winter supply of the London market, states that some growers there, unable to meet the expense of the usual methods of heating the structures, adopted the rough method of warming them by burning wood or charcoal in open braziers. This, of course, kept the houses constantly full of smoke, but so far from this proving an injury, it was found that the plants flowered at least two weeks earlier than in houses heated by pipes or flues, and the gain was so great that even in the latter the owners now keep up a smoke by burning straw or wood chips.

Plants, of many kinds at least, flourish the more for being in an atmosphere of ammonia and carbonic acid, but whether these ingredients of the smoke are the prime cause of its beneficial effect is doubtful. The writer has had occasion to make slight temporary wood fires three or four times a week in the furnace of a small greenhouse in which grape vines are fruiting. This has lately been discontinued for fear of the grapes contracting a smoky flavor. Some thrips had got into the house, but the smoke seems to have driven them into the farthest corner, where they have eaten the leaves thin. In all the rest of the house the foliage is beautifully clear and green. In hopes of destroying the thrips, a pan of smoking chips was put under them in their corner. They immediately began to flit away toward the smoke-preserved foliage. So the smoke seems to drive them off, but not to kill them. Yet that is a gain, while the healthy, perfect growths in the smoke give promise of a fine crop of good fruit next year.—*Country Gentleman.*

ACTION OF CHEMICAL REAGENTS UPON VEGETABLE FIBERS.

Linen.—Sulphuric acid, cold and concentrated, almost dissolves the fiber; ammoniuret of copper gives rise to an irregular swelling, and finally also dissolves the internal membrane. Sulphate of aniline indicates the variable quantities of ligneous matter; caustic potash gives it an orange yellow color.

Hemp.—Sulphuric acid gives it a green color; ammoniuret of copper produces a strong swelling and a partial solution, the internal membrane remaining in a folded state; sulphate of aniline gives a very intense coloration; potash colors it an orange yellow.

Jute.—After a preliminary treatment with dilute chromic acid, to which a little sulphuric acid has been added, jute takes a blue color. Ammoniuret of copper swells it slightly; sulphate of aniline produces a very intense yellow coloration, proving that the fiber is strongly lignified.

Phormium tenax (New Zealand flax).—Fuming nitric acid colors the unaltered liber-cells red, but not the fiber after being bleached, or even steeped. Ammoniuret of copper produces a slight swelling; sulphate of aniline colors the fiber a pale yellow, indicating a slight degree of lignification.

Additional characteristics are that linen is dyed orange by the tincture of madder; magenta, followed by a brief immersion in ammonia, gives it a fine red color. It is tinged black by the anhydrous perchloride of tin; a slight yellow by soda lye; iodide of potassium communicates to it a blue stain, and ultimately almost dissolves the cellules; if steeped in oil or glycerine, and strongly pressed, it becomes transparent.

The raw fiber of hemp is decomposed and rendered brittle by hydrochloric acid; soda has the same action as potash; the raw fiber is colored by ammonia, at first green and then yellow; but the steeped fiber takes a pale violet.

Phormium tenax is colored violet by chlorine water and ammonia.

M. Cossa, of the Academy of Sciences, Paris, maintains that cerium, lanthanum, and didymium are widely diffused throughout nature and enter into the composition of organic as well as of inorganic bodies. He has found these three metals in the sheelite of Meyac, in the staffelite of Nassau, and in phosphorites, osteolites, and coprolites from various places. He has detected them also in the saccharoid marble of Carrara, and in the shelly limestone of Avellino. Bone ash used for the preparation of cupels yielded three centigrams per kilo of the oxalates of the three metals.

A bottom of aniline gray, according to Strassny, is the best way to economize indigo. The goods are padded in a 5 to 7 per cent. solution of a salt of aniline. Sal-ammoniac and chlorate of potash are added to the extent of one-fourth the weight of the aniline salt, and the salt of copper is used sparingly. The pieces are then dried, aged, washed, taken through soda, washed, and dyed to shade in the vat. The process is beset with difficulties if a pattern is to be produced.

According to the *Chemiker Zeitung* Langbeck detects methylic alcohol in ether and chloroform as follows: He mixes ten volumes of the suspected sample with one volume of a dilute solution of nitrate of silver (1 seven-tenths per cent.), and lets the mixture stand for 24 hours. After the lapse of this time the line of contact between the two liquids takes a faint reddish-violet color, and a reddish-brown sediment of oxide of silver is formed, more or less plentiful, according to the proportion of methyl present.

Preparation of Flax and Hemp without Rot-Steeping.—It is well known that flax and hemp are ordinarily prepared for use by being laid to steep in water until the extractive and gummy matters are destroyed by putrefaction. The smell given off by the steeping pits is extremely offensive, and in flax growing districts there are frequent complaints of rivers and wells being contaminated by the escaping waters. M. Lefebure first removes the so-called straw, the outer coating of the flax stem, by the aid of a machine, into which the flax enters in its green state, and comes out in a few seconds perfectly decorticated. It is then plunged in a solution of soda, which frees it entirely from gum without the least injury to the fiber. The duration of this second operation is from two to five hours, according to the more or less serious nature of the sample. In addition to the suppression of nuisance, the flax is obtained in a state of complete disaggregation, and without any injury to the fiber, and is necessarily finer, stronger, and more regular.